THE SERGESTIDÆ OF THE SIBOGA EXPEDITION

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SERGESTIDÆ OF THE SIBOGA EXPEDITION

BY

H. J. HANSEN
GJENTOFTE (near COPENHAGEN)

With 5 plates and 14 text figures

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This well defined and most interesting family has with good reason been divided into two sub-families: Sergestinæ and Luciferinæ. The first sub-family comprises four genera: *Sergestes* H. Milne-Edw., *Petalidium* Sp. Bate, *Sicyonella* Borradaile (*Aphareocaris* Calm.) and *Acetes* H. Milne-Edw., while the genus *Lucifer* Vaughan Thomson (*Leucifer* H. M.-Edw.) constitutes the Luciferinæ. With exception of *Petalidium* all genera are represented in the "Siboga" collection. Of *Sergestes*, *Sicyonella* and *Acetes* the expedition has secured a good material, containing some undescribed species, while the collection of *Lucifer* is exceedingly rich. The Zoological Museum in Copenhagen possesses of the genera in question a good material, which in many cases has been most useful for comparison, and with the kind allowance of the Editor of the "Siboga" work I have even been able to include in the present paper descriptions with figures of forms — most of them from the Indo-Chinese seas — not gathered by the "Siboga" of the hitherto imperfectly known genus *Acetes*. As the degree of our knowledge of the four genera is very different, it is found adequate to deal with each genus according to the state of the literature.

In the treatment of the genera and species I have introduced a special study of the male copulatory organs on the first pair of pleopods, the petasma. Various authors have published a more or less good outline of the petasma of a single form or of two species, but only one author, S. J. Smith, has given a more detailed representation of the petasma in a single species (*Sergestes robustus* Smith), and nobody has attempted a comparative investigation in any of the genera. As in the order Euphausiacea, the petasma has shown itself to afford as a rule the best and most reliable specific characters; it is always very important, and in some cases it is even absolutely necessary to possess an adult male in order to be able to determine a

species with absolute certainty, to separate it from a closely allied form taken in the same or in another sea. Therefore I give a detailed representation of the petasma in every species. As the organ is very complicate in the genus *Sergestes*, while it is more or less reduced in the other genera, it will be expedient to give a description of the petasma in the general treatment of the genus named, and later on at each of the other genera to mention its reduction or structure.

I. Sub-Family Sergestinæ.

Sergestes H. Milne-Edw.

This genus was established in 1830 by H. Milne-Edwards (Ann. Sci. Natur. t. XIX, 1830) on a single species. Since that remote year numerous authors have published larger or smaller contributions to our knowledge, but among them only some of the most important are mentioned here. — In 1859 a valuable paper was published by Henrik Krøyer (Forsøg til en monographisk Fremstilling af Kræbsdyrslægten Sergestes, in: K. D. Vidensk. Selsk. Skrifter, 5. Række, naturv.-math. Afd., 4. B.), in which he described and figured on five plates 15 species, all new, but the majority of them briefly characterized by him in a preliminary paper in 1855. — In three papers published 1882—86 S. J. Smith gave excellent descriptions with good figures of 3 species from the Atlantic. — In 1888 the great work by C. Spence Bate on Decapoda Macrura (Rep. Voy. "Challenger", Zool., vol. XXIV) was issued, in which a very large contribution to our knowledge of *Sergestes* and its larval forms is found; the author established in all 24 species of *Sergestes* as new. — Some years after I wrote a treatise on this genus (On the Development and the Species of the Crustaceans of the genus Sergestes, in: Proc. Zool. Soc. London, Dec. 1, 1896). It contains a review of the whole literature from 1830 to 1895 and an enumeration of all species, in all 59 (or, if the dead-born genus *Sciacaris* Bate is included, 60 species) of the genus *Sergestes*. Furthermore it is proved that only about 20 of these species have been established on adult animals, and that some of these species must be cancelled as synonyms, while the remaining majority, nearly two scores of species, had been founded on larval forms in the *Mastigopus*-stages; besides it was shown that some of the larvæ established as separate species are *Mastigopus*-stages of species already known as adults, while other larvæ belong to forms unknown in the adult stage. Finally, based on the literature and on a rich material of adults and larvæ of forms living near the surface and belonging to the Copenhagen Museum, I gave a view of all forms. — A later publication of mine (H. J. Hansen: The Crustaceans of the genera *Petalidium* and *Sergestes* from the 'Challenger', with an account of luminous organs in *Sergestes challengeri* n. sp., in: Proc. Zool. Soc. London, Jan. 20, 1903) contains a critical revision of the "Challenger" material preserved in the British Museum (Natural History); its most important point is the discovery of a large number of complex luminous organs in a single form. — It is deemed unnecessary to enumerate here the numerous papers published since 1895, which contain contributions on *Sergestes*; some among them are quoted on the following pages.

The copulatory organs, the petasma, much be dealt with at length. In 1913 K. STEPHENSEN (The copulatory Organ (Petasma) of *Sergestes vigilax* (Stimps.) H. J. H., in: Mindeskrift for Steenstrup, 1913) showed that the petasma begins to be visible in the *Mastigopus*-stage and has a gradual development; he gives six figures to illustrate the development and makes some remarks on them, but he did not undertake a more close comparative investigation. For the rest, already in 1896 I had pronounced (op. cit.) that "the petasma itself does not become completely developed at once to its final shape". But when STEPHENSEN writes: "As may be seen the petasma varies very much with the age, and thus may not be used as a specific character", this conclusion is extremely wrong. In the order Euphausiacea the copulatory organs, to which also the not very necessary name "petasma" could be applied, show a gradual development, but while it in the adult specimens is of extreme importance for the separation of species — and ZIMMER, TATTERSALL and others have followed me as to this nearly fundamental question — I have as a rule not taken into account the lobes and processes in not full-grown males, and at least in its earlier stages the petasma is too little developed. And the state of things is the same in *Sergestes*. But in order to obtain good and practical results it is necessary to adopt an appropriate plan as to the petasma in adult specimens and to carry through a nomenclature for its essential elements. According to my experience from the Euphausiacea, I think that the left organ ought as far as possible to be chosen; when the animal is seen from below consequently the petasma on the side turning to the right. This organ is cut off, laid on a glass-plate in glycerine diluted with water, cautiously spread as far as possible by the aid of two minute knifes, then a small glass-cover is applied in such a way that the organ is not much pressed, and the organ is then drawn, consequently from behind (from below). Furthermore the distal portion of its median and most important, ramified part ought to be drawn with a higher degree of enlargement both from behind and, after the organ has been turned, from in front. When each petasma of several species has been drawn with its lobes turning upwards on the paper in the way described, the organs are easily compared and the differences affording specific characters catch the eye. The right organ is completely symmetrical with the left, but the latter ought to be preferred. It may be added that when one has made himself acquainted with the petasma in a few species or when he has a number of satisfactory figures at hand, he may as a rule find it unnecessary to remove the petasma from any male in order to use it for determination, as the examination with a good pocket-lens will be sufficient.

The petasma consists of three main-parts, viz. pars media (Pl. I, fig. 1*a*, *m.*, fig. 2*a*, *m.*, fig. 6*e*, *m.*), an inner plate, pars astringens (Pl. I, *a.* in figs. 1*a*, 2*a*, 3*b*, 7*a*; Pl. II, *a.* in fig. 2*g*), and an outer plate, pars externa (Pl. I, fig. 1*a*, *e.*). Pars astringens (*a.*) is always a thin and generally rather large plate, which is fixed along the proximal portion of the inner margin of pars media; the plate has generally a longitudinal folding, and its inner margin which is long and straight, is equipped with a large number of extremely small hooks, by which the plate of the left organ is coupled with the corresponding plate of the right one. Pars externa (*e.*) projects from the proximal part of the outer margin of pars media; it consists of a rather large plate, lamina externa (Pl. I, *lam.* in figs. 1*a*, 2*a*, 3*b*, 6*e*, 7*a*, and Pl. II, *lam.* in fig. 2*g*) which anteriorly is produced into a generally long process, processus

uncifer (*pu.* in the same figures), a name chosen for the reason that in most species (but not in *S. orientalis*, Pl. II, fig. 2*g*) it is deeply incised at the end on the inner side, so that a strong hook is formed. Pars media (Pl. I, fig. 1*a*, *m.*, fig. 2*a*, *m.*, fig. 6*e*, *m.*) is the largest and by far the most important portion of the petasma; it is connected with the peduncle of the pleopod by a short piece projecting from the outer side near the base (see f. inst. Pl. I, fig. 7*a*); at the origin of that piece is found a process, processus basalis (Pl. I, *pb.* in figs. 1*a*, 2*a*, 3*b*, 6*e*, 7*a*) directed (on the figure) backwards and inwards, and differing in shape according to species. Inside that process is seen an incision, and inside this the inner proximal portion of pars media, which has its proximal margin incurved and in the main transverse. More or less beyond the middle pars media is ramified, with a process and some branches or lobes. I have attempted to find out the homologies of these ramifications in the different species and have named them accordingly, because it is necessary to mention each process in the description of the species. The first of these ramifications is named processus ventralis (*pv.* in the figures), as it originates on the posterior or lower side of pars media; it differs exceedingly in shape and affords excellent characters, as may be observed by a comparison of *pv.* in the following figures on Pl. I: figs. 1*b* and 1*c*, 2*b* and 2*c*, 3*c* and 3*d*, 4*f* and 4*g*, 7*b* and 7*c*, and it has no hooks excepting in *S. Gardineri* (figs. 2*b* and 2*c*), while in *S. seminudus* (figs. 7*b* and 7*c*) it is armed with thick, short spines, and in *S. orientalis* (Pl. II, fig. 2*h*, *pv.*) it is quite small. The portion beyond the origin of processus ventralis is named capitulum, and it has generally four lobes, in a few cases five or six. The most proximal lobe projects mainly on the outer side and is named lobus armatus (Pl. I, *la.* in figs. 1*b* and 1*c*, 2*b* and 2*c*, 3*b* and 3*c*, 7*b* and 7*c*, and more anomalous in figs. 4*f* and 4*g*, 6*f* and 6*g*); it has always a number of hooks; the arrangement of these hooks and sometimes their size together with shape and size of the lobe afford fine characters. The hooks on this lobe and on most or all the other lobes show considerable differences in shape and extreme differences as to size, and the membrane around them is generally invaginated, frequently to such a degree that the hook is completely retracted. (In 1882 S. J. Smith published a good description with figures of such hooks in *Sergestes robustus*). The three other lobes are named respectively: lobus connectens (*lc.*) which projects mainly outwards and has a single hook or generally a number of hooks; lobus terminalis (*lt.*) which varies as to hooks, and lobus inermis (*li.*) which originates at the inner margin of the capitulum, possesses hooks in *S. Gardineri* (figs. 2*a* and 2*b*) but not in the other forms, and is wanting in *S. Challengeri* and *S. fulgens* (Pl. I, figs. 4*f* and 4*g*, figs. 6*f* and 6*g*). But in the two last-named species we find on the anterior side of the capitulum near the origin of processus ventralis two lobes, lobi accessorii (*lac.* on the figures quoted) which have no equivalent in the other species, and both are armed with hooks. In *S. orientalis* and *S. Edwardsii* a lobus accessorius is observed on the posterior side of the capitulum towards its inner margin (Pl. II, *lac.* in figs. 2*h*, 2*k* and 3*a*).

In 1896 I divided the species of *Sergestes* into two groups according to the length and thickness of the third pair of maxillipeds as compared with third pair of legs, and the equipment with bristles or spines on their distal joints. With a small amelioration in the wording of the second of the two diagnoses this division is still very useful, and is reprinted later on.

The first of these groups was divided into two sub-groups according to the relative length of the ciliated part of the outer margin of the exopod of the uropods, and this character is still valid. Since 1896 some new species have been established; besides I have seen adult specimens of a good number of species unknown to me twenty-two years ago, and my special study of the petasma shows that most species must be revised, as there exists some hitherto unrecognized forms, and that many of the statements on distribution in the literature are not trustworthy. Though I have far from finished my intended investigations of the genus *Sergestes* (and *Petalidium*) [1]) I think that a new tabular view of the species of the first group may be useful. But before undertaking this attempt some remarks on the synonymy etc. ought to be made. (On the forms of the second group nothing new can be communicated here, as the "Siboga" gathered only a single species).

Sergestes tenuiremis Kr. was established on a specimen in the *Mastigopus*-stage. In 1896 I stated that a specimen measuring 23 mm. had just acquired the black eyes, but I thought that the adult was unknown. The study of partly new material from the Atlantic yielded the result that *S. tenuiremis* must be the *Mastigopus* of *S. Kröyeri* Bate or more probably of *S. phorcus* Faxon, two species which are more closely allied than hitherto supposed. But as it seems to be impossible to decide with absolute certainty whether the Kröyerian larva belongs to *S. phorcus* or to the other form I propose to drop the name *tenuiremis*, at most keeping it as a designation for that elongated larval form.

Of *S. bisulcatus* Wood-Mason I have examined a co-type from the Indian Museum, Calcutta, and three specimens described later on from the "Siboga". All specimens agree on the whole well with ALCOCK's description. In 1893 FAXON established *S. phorcus*, but in 1895 he referred his specimens "with some doubt" to *S. bisulcatus* Wood-Mason. Judging not only from the shape of the rostrum as figured by FAXON, but especially from his figure of the petasma his form cannot belong to WOOD-MASON's species, and consequently the name *S. phorcus* must be re-established. In his "South African Crustacea", Part III, 1905, STEBBING describes and figures a form which agrees excellently with *S. phorcus*, but not with *S. bisulcatus*, though he follows FAXON in applying the latter name and cancelling *S. phorcus* as a synonym. In the material collected by the Prince of Monaco several adult specimens of *S. phorcus* are found.

S. prehensilis Bate is closely allied to *S. bisulcatus* Wood-Mas., but the eyes are larger with shorter stalks, the antennular peduncles shorter as compared with the squama, and the distal part of their first joint is broader. Besides the petasma of *S. prehensilis* Bate differs very considerably from that of *S. bisulcatus*; Dr. W. T. CALMAN has kindly examined the petasma in the holotype of *S. prehensilis* Bate in the British Museum (Natural History) for me, and according to his figures of the distal half of pars media the processus ventralis tapers from the base to the obtuse end, lobus armatus is not half as long as in *S. bisulcatus*, with 3 hooks on or near the end, lobus terminalis is thicker with about 7 hooks on the most distal part of its posterior side, lobus inermis is nearly twice as broad as long and with the end feebly

1) A paper on the Sergestidæ gathered by the French expeditions "Travailleur" and "Talisman" in the Mediterranean and the Atlantic is nearly ready for the press, and at present I work out the Sergestidæ collected by the Prince of Monaco in the same seas. Besides I hope later to study a fine material from the Pacific, etc.

produced [1]). *Sergentes prehensilis* Nobili (1906) from lat. 14° 57′ N., long. 51° 10′ E. cannot be *S. prehensilis* Bate or *S. bisulcatus* Wood-Mason; whether is may be *S. phorcus* Faxon is very uncertain.

Whether *S. mollis* Smith from the North Atlantic is only a synonym to *S. japonicus* Bate cannot be settled with absolute certainty before the petasma of a male from the Japanese seas has been studied; BATE's types in the British Museum are females. At present I am apt to maintain my earlier opinion that *S. mollis* Smith is a synonym to *S. japonicus* Bate.

S. rubro-guttatus Wood-Mason (1891) is probably impossible to determine with any certainty from the description in the literature. An adult specimen received from the Museum in Calcutta is an adult male of *S. corniculum* Kr.. But from the "Siboga" I have a number of specimens of a closely allied form, *S. seminudus* n. sp., which can only be separated from *S. corniculum* Kr. by the structure of the petasma. As I do not know whether *S. seminudus* is also to be found in the Bay of Bengal, the Andaman Sea or the Arabian Sea, it is impossible to decide whether under the name *S. rubro-guttatus* A. ALCOCK has only referred specimens of *S. corniculum* Kr. or besides some belonging to *S. seminudus* n. sp.

Diagnoses of the two Groups.

Group I: Third maxillipeds at most but little longer, sometimes shorter than third pair of legs; it first joint rarely, the second-fourth joints never obviously incrassated in proportion to the joints in third legs, its two distal joints with numerous bristles along both margins.

Group II: Third maxillipeds considerably or much longer than third pair of legs, its four proximal joints considerably or (generally) very much incrassated or partially almost inflated in proportion to the joints in third legs, its two distal joints with a lesser number of bristles, most of them or all small or minute, or totally naked along the one margin, the sixth joint with a number of spines very different in length along the other margin, and a feebler armature may also be found on the fifth joint.

Conspectus of the Species of Group I.

Only adult and subadult specimens are taken into consideration.

A. On the exopod of the uropods the ciliated part occupies considerably less than half of the exterior margin.

a. The two distal joints of the antennular peduncles slender; third joint as long as or longer than the inner margin of the second. Supra-ocular and hepatic spines well developed.

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1) *S. prehensilis* Nakazawa and Terao (Zool. Mag. Vol. XXVII, n° 329) must be quite different from *S. prehensilis* Bate, as pars media of the petasma according to their figure (kindly copied for me by Dr. W. T. CALMAN) differs extremely from that in *S. prehensilis* Bate and every other species of the genus seen by me.

α. Third joint of the antennular peduncles as long as or longer than first joint.
Species 1—2: *S. atlanticus* M.-Edw. (*S. Frisii* Kr.), and *S. cornutus* Kr.

β. Third joint of the antennular peduncles very considerably shorter than first joint.
Spec. 3—4: *S. arcticus* Kr., and *S. affinis* H. J. H.

b. The two distal joints of the antennular peduncles considerably or much thickened; third joint slightly or very considerably shorter than the inner margin of the second. Supra-ocular spines always, hepatic spines most frequently wanting.

α. Eyes seen from above scarcely or at most a little broader than their stalks. Third joint of the antennular peduncles slightly shorter than the inner margin of second joint. Integument of the body soft and completely membranaceous.
Spec. 5—7: *S. japonicus* Bate (*S. mollis* Smith), *S. inous* Faxon, and *S. profundus* Bate.

β. Eyes seen from above considerably or much broader than their stalks. Third joint of the antennular peduncles somewhat or considerably shorter than the inner margin of second joint. Integument of the body moderately soft or somewhat rigid, less membranaceous.

†. No luminous organs on the body or the appendages.

§. A process or protuberance on the inner side of the eye-stalks near the eye. Spec. 8—9: *S. Kröyeri* Bate, and *S. Gardineri* Kemp.

§§. No distinct protuberance on the eye-stalks (in *S. phorcus* a feeble rudiment of a protuberance).
Spec. 10—13: *S. phorcus* Faxon, *S. bisulcatus* Wood-Mas., *S. prehensilis* Bate, and *S. robustus* Smith.

††. Numerous luminous organs distributed on the body, especially on its lower surface, and on most of the appendages.
Spec. 14—17: *S. Challengeri* H. J. H., *S. fulgens* n. sp., (*S. splendens* n. sp. in MS., Atlantic), and *S. gloriosus* Stebb.

B. On the exopod of the uropods the ciliated part occupies somewhat more than half of the exterior margin. (Slender forms with the antennular peduncles long).
Spec. 18—19: *S. corniculum* Kr., and *S. seminudus* n. sp.

It may be added that this conspectus is not only an analytical key aiding at the determination of specimens, but it gives besides a kind of classification, as the forms are collected into small natural tribes. (*Acheles arachnipodus* Cocco (1832), which seems to be a species of *Sergestes*, is omitted, as it is probably impossible to recognize the form with complete certainty; "*Sergestes arachnipodus* De Natale (ex Cocco)" as described and figured by Riggio (1905), must, according to the equipment with spines of processus ventralis of the petasma, be *S. arcticus* Kr.).

The material collected by the "Siboga" comprises adult specimens of seven species.

A good part of the larvæ can be determined, and among them are found specimens in the *Mastigopus*-stages of *S. atlanticus* M.-Edw., of which adult specimens were not taken, but as these larvæ can be determined with certainty, *S. atlanticus* is dealt with below. — A single specimen of a *Mastigopus* belongs to a hitherto unknown species of Group II, but it is omitted as being somewhat mutilated and besides indeterminable.

1. *Sergestes atlanticus* M.-Edw.

1830. *Sergestes atlanticus* H. Milne-Edwards, Ann. Sci. Natur. T. XIX, p. 346, Pl. X.
1859. *Sergestes Frisii* Kröyer, Kgl. Danske Vid. Selsk. Skrifter, 5. Række, Naturv.-math. Afd. IV, 2, p. 235, Tab. I, Fig. 1, *a—v*.
1888. *Sergestes atlanticus* Bate, Challenger Rep. Vol. XXIV, p. 389, Pls. LXVIII & LXIX (at least partially).
1896. *Sergestes atlanticus* H. J. Hansen, Proc. Zool. Soc. London for Dec. 1, 1896, p. 951.
1903. *Sergestes atlanticus* H. J. Hansen, Proc. Zool. Soc. London for 1903, p. 58.

The Mastigopus.

1859. *Sergestes ancylops* Kröyer, l. c. p. 262, Tab. III, Fig. 8, *a—e*.
1888. *Sergestes ancylops* Bate, l. c. p. 413, Pl. LXXV, fig. 2.
1888. *Sergestes ovatoculus* Bate, l. c. p. 408, Pl. LXXIV, fig. 2.
1896. "*Sergestes ancylops*" H. J. Hansen, l. c. p. 952.

Stat. 203. Sept 19. Lat. 3° 32′.5 S., long. 124° 15′.5 E. HENSEN vertical net, from 1500 m. 1 *Mastigopus*.
Stat. 225. Nov. 8. 5700 m. N. 279° E. from Southpoint of South-Lucipara-island. Horizontal cylinder. 1 *Mastigopus*.
Stat. 276. Jan. 9. Lat. 6° 47′.5 S., long. 128° 40′.5 E. HENSEN vertical net, from a depth of 750 m. 1 *Mastigopus*.

The curious shape of the eyes, seen from above, renders the *Mastigopus* of *S. atlanticus* easy to distinguish from all other forms hitherto known. In 1896 I pointed out that S. *ancylops* Kr. and *S. ovatoculus* Bate are animals in *Mastigopus*-stages of *S. atlanticus*, and in 1903 I gave a critical revision of the animals referred by BATE to *S. atlanticus*.

The Copenhagen Museum possesses an extremely large collection of adult and subadult specimens of *S. atlanticus*, all gathered near the surface or at most in some few fathoms below it, and generally during the nights. *S. atlanticus* belongs to the open ocean, and it is one of the few species of *Sergestes*, which during all stages live near or not very far from the surface.

2. *Sergestes inous* Faxon. Pl. I, figs. 1*a*—1*c*.

1893. *Sergestes inous* Faxon, Bull. Mus. Comp. Zool. Vol. XXIV, p. 216.
1895. *Sergestes inous* Faxon, Memoirs Mus. Comp. Zool. Vol. XVIII, p. 208, Pl. LI, figs. 2—2*d*.
1901. *Sergestes* sp.? *inous* Alcock, Descr. Catal. Indian Deep-Sea Crust. Dec. Macrura and Anomola, p. 50.

Stat. 35. March 28. Lat. 8° 0′.3 S., long. 116° 59′ E. 1310 m. Deep sea trawl. 1 large male.
Stat. 175. August 30. Lat. 2° 37′.7 S., long. 130° 33′.4 E. 1914 m. Deep sea trawl. 1 immature male.
Stat. 208. Sept. 22. Lat. 5° 39′ S., long. 122° 12′ E. 1886 m. Deep sea trawl. 1 immature specimen.

The large male measures 88 mm. from the tip of the rostrum to the apex of the telson; though very large, it is considerably smaller than FAXON's type, which was 113 mm. long. This species is similar and very closely allied to *S. japonicus* Bate (*S. mollis* S. I. Smith) but it is very much larger, and differs, as already pointed out by FAXON and ALCOCK, sharply by the posterior branchia of third pair of thoracic legs. The specimens from the "Siboga" have the third maxillipeds mutilated, consequently I cannot fill up the gap in our knowledge.

The petasma (figs. 1*a*—1*c*) which affords specific characters, has never been described. Lamina externa (*lam.*) of pars externa (*e.*) is very long, a little longer than processus uncifer (*pu.*), and its proximal half has its outer margin slightly convex. The processus basalis (*pb.*) is rather slender, moderately short, with an acute angle on the otherwise moderately broad terminal part. The middle portion of pars media (*m.*) is rather slender. Processus ventralis (*pv.*) is long, nearly straight, moderately slender, slightly broader beyond the middle than at the base, while its distal fifth tapers to the subacute end. Lobus armatus (*la.*) is much curved, decreasing from before the middle to the narrowly rounded end; somewhat less than its proximal half of the inner side has a moderate number of invaginated hooks, and a somewhat shorter distal portion of the anterior and the outer sides has several hooks, while the long middle portion of the lobe is completely unarmed. Lobus connectens (*lc.*) is long, protruding beyond the other rami of pars media, thick at the base, subconical, with the end narrow but obtuse; the outer surface of the lobe has a good number of hooks, the most proximal among them quite small, and the terminal narrow part of the lobe has similar small hooks both on the inner and the anterior surface. Lobus terminalis (*lt.*) is very short and thick, with a moderate number of small hooks at the end and along the distal part of the outer and the inner margin. Lobus inermis (*li.*) is only about one-third as long as lobus connectens, curved, very slender with the end acute and without any hooks. Pars astringens (*a.*) does not exhibit any peculiarities.

The petasma described is allied to that of *S. japonicus* [1]), but differs in several features; lobus inermis is more slender, curved and acute; lobus connectens has its proximal two-thirds much thicker and besides a lower number of hooks, as the lobe in *S. japonicus* has numerous hooks on the major part of its posterior surface and at the distal half of the inner margin; lobus armatus is much thicker than in the other form and its long middle portion without hooks, while in *S. japonicus* the lobe has numerous hooks distributed in its whole length both on the posterior side and especially on its anterior side towards the inner margin. Among these characters those found in the last-named lobe are probably the most valuable.

Distribution. — The type was secured in the tropical East Pacific at lat. 4° 3′ N., long. 81° 31′ W., 899 fathoms. The specimen described by ALCOCK has been taken in the Arabian Sea, 1091 fathoms.

3. *Sergestes Gardineri* Kemp. Pl. I, figs. 2*a*—2*c*.

1913. *Sergestes gardineri* Stanley Kemp, Trans. Linn. Soc. Lond. 2. ser., Zool. Vol. XVI, pt 1, p. 55, Pl. 7, figs. 2—5.

1) Figured in my forthcoming report on the Sergestidæ from the "Travailleur" and the "Talisman".

Stat. 141. August 5. Lat. 1°0′.4 S., long. 127°25′.3 E. 1950 m. HENSEN vertical net, from 1500 m. depth to surface. 1 adult male.

Stat. 230. Nov. 14. Lat. 3°58′ S., long. 128°20′ E. HENSEN vertical net, from a depth of 2000 m. to surface. 1 adult female.

This species is somewhat small; the largest "Siboga" specimen, the female, is 26 mm. long, and the adult male a little smaller. The body is somewhat thick, the legs moderately short and a little robust. It has on the whole been well described by KEMP, but the eyes and their stalks do not agree fully with his figures, and besides some particulars and especially a representation of the petasma must be added.

The carapace and its rostrum has been fully described by KEMP; it may be noted, that the distal part of the rostrum, beyond the dorsal tooth, is more straight in my animals than figured by him. His description and figures of the eyes disagree somewhat with my specimens; the eyes are in both sexes conspicuously larger than figured by KEMP and considerably broader than their stalks, somewhat broader than deep; besides the cornea is as long as the outer margin of the distal joint of the stalk; the protuberance at the inner margin of the stalk near the cornea is a little conical, quite low, and broadly obtuse. — KEMP's statement that in the antennulæ the third joint of the peduncle is slightly longer than the second does not agree with his fig. 3, as the inner proximal part of second joint must be counted; in reality second joint is in the female a little longer than the third, and in the male the difference in length is still more conspicuous; besides the second joint is somewhat thicker in the male than in the female, while there is considerable difference in the third joint between the sexes, as in the female it is about as broad as deep, while in the male it is a little obliquely compressed, seen from above as broad as in the female, but much deeper than broad. The two proximal joints, and especially the first joint, of the clasping organ in the male are short and somewhat thick, but the organ is unfortunately rather mutilated. The antennal squama has its rather narrow end more transverse and the outer terminal tooth longer than in KEMP's fig. 3; the squama has numerous small darker dots arranged in its whole length in a straight line a little nearer to the inner than to the outer margin.

To KEMP's description of the appendages may be added that third pair of maxillipeds is a little shorter and more slender than third pair of legs; in the only maxilliped not mutilated I was unable to detect any subdivisions of the terminal joint. Fourth pair of legs, when directed forwards, reaches slightly beyond the end of the rostrum; their two distal joints are somewhat broad, the terminal one being scarcely five times as long as broad; fifth pair of legs about half as long as the fourth. As to the branchiæ and the uropods is referred to KEMP.

The petasma (figs. 2*a*—2*c*) is very characteristic. Lamina externa (*lam.*) of pars externa is short, much shorter than processus uncifer (*pu.*) and has its outer margin concave at the middle; the process named differs from that in other forms by the shape of the subterminal incision, which in *S. Gardineri* is longer than deep, while in other species it is narrow, deeper than long. Processus basalis (*pb.*) is very broad, moderately long, distally very broadly rounded. Pars media is moderately robust at the middle. Processus ventralis (*pv.*) is long, curved, scarcely tapering from somewhat from the base to the end, which is cut off obliquely and equipped

with about six hooks of middle size. Lobus armatus (*la.*) is of moderate size, thick at the base and tapers to the end; it has a good number of hooks along the inner side from rather near the base to the end, and a few hooks on the front side near the end. Lobus connectens (*lc.*) is not half as long as lobus armatus and as thick as processus ventralis at the middle; it has a good number of hooks on most of its anterior side and a few on the posterior side. Lobus terminalis (*lt.*) is long, straight, a little tapering, with about four hooks spread along the outer margin and three hooks at the most distal part of the inner margin. Lobus inermis (*li.*) is long, thicker than the other lobes, somewhat curved, distally tapering to the obtuse end, with about four hooks at the distal part of the outer margin and three large hooks at the distal part and the end of the inner margin.

Remarks. — In possessing a very distinct protuberance on the eye-stalks near the cornea *S. Gardineri* agrees with *S. Kröyeri* Bate, but differs from all other species of this sub-group (in the other sub-group, comprising *S. corniculum* Kr. and *S. seminudus* n. sp., a distinct protuberance is less or more developed). *S. Gardineri* differs from *S. Kröyeri* in being much smaller, in having the protuberance mentioned much lower and of another shape, in a totally differently formed rostrum, and other particulars. The petasma in *S. Kröyeri* has never been described; that in *S. Gardineri* differs from those hitherto known of the species in group I in three features, viz. the shape of the subterminal incision in processus uncifer, the occurrence of hooks on the end of processus ventralis, and the existence of hooks on lobus inermis.

Distribution. — Kemp recorded several specimens from three localities in the western part of the Indian Ocean somewhat south of the line, two among them in depths between 750 and 500 fathoms.

4. *Sergestes bisulcatus* Wood-Mason. Pl. I, figs. 3*a*—3*d*.

1891. *Sergestes bisulcatus* Wood-Mason, Ann. Mag. Nat. Hist. 6 ser. Vol. VII, p. 190.
1901. *Sergestes bisulcatus* Alcock, Illustr. Zool. Investigator, Pl. L, figs. 1, 1*a*, 1*b*.
1901. *Sergestes bisulcatus* Alcock, Descr. Cat. Indian Deep-Sea Crust. Dec. Macrura and Anomala, p. 49.

Stat. 46a. April 7. Lat. 8° 0′.5 S., long. 118° 34′.7 E. 1600 m. Deep sea trawl. 1 adult female.
Stat. 185. Sept. 12. Lat. 3° 20′ S., long. 127° 22′.9 E. Manipa Strait. Hensen vertical net, from 1536 m. to surface. 1 adult male.
Stat. 217. Oct. 31. Lat. 6° 40′.6 S., long. 123° 14′.7 E. 2477 m. Deep sea trawl. 1 immature specimen.

In general aspect somewhat similar to *S. robustus* S. I. Smith. Alcock has published a description which on the whole agrees well with the "Siboga" specimens and with a co-type received by the Copenhagen Museum many years ago from the Museum in Calcutta. Here it may be sufficient to mention some particulars and describe the petasma.

The rostrum is somewhat ascendant (fig. 3), moderately long, acute; the lower margin has its distal third or nearly more than its distal half feebly or somewhat concave, while the upper margin is a little or slightly convex or feebly angular beyond the middle. The eyes are large, nearly as long as broad, distinctly depressed, much broader than the stalk and slightly

longer than the outer margin of its distal joint; the stalk is manifestly longer than in *S. robustus*. The antennulæ in the main as in *S. robustus*, but second and third joints of the peduncle are distinctly less thick, especially third joint is longer in proportion to its depth than in *S. robustus*, and there is much less difference between the thickness of its proximal part and near its end than in the species named; furthermore third joint is similar in both sexes, somewhat compressed, and conspicuously shorter than second joint. The antennal squama is rather far from reaching the middle of the third peduncular joint of the antennulæ; it has the terminal margin of moderate length, a little convex and nearly transverse, and the marginal spine is well developed. The terminal joint of third maxillipeds is divided into four joints subequal in length, but each of the two distal subjoints is again divided into two joints; the result is thus six subjoints in all. Fourth pair of legs, when stretched forwards, reach a little beyond the apex of the rostrum; the two distal joints are proportionately narrower than in *S. Gardineri*. The posterior branchia above third pair of legs is a little more than two-thirds as long as the anterior, and about as long as the second branchia above fourth legs, while this last-named branchia is scarcely three-fourths as long as the anterior branchia above the same legs. All these four branchiæ are long and closely set, rather similar to those in *S. robustus*, from which they differ in the feature, that the posterior branchia of each of the two sets is shorter in comparison with the anterior branchia of the same segment than in *S. robustus*.

Alcock's description of the petasma is completely insufficient. — Lamina externa (*lam.*) of pars externa is short, much shorter than processus uncifer (*pu.*), with the outer margin feebly angular a little beyond the middle, and its proximal part nearly straight; processus uncifer is uncommonly slender, with the subterminal incision normal, somewhat deep. Processus basalis (*pb.*) is nearly straight, rather slender, moderately short, slightly broader beyond the middle than at the base, with the distal fourth rapidly tapering to the acute end. Processus ventralis (*pv.*) is rather long, moderately strong, a little curved, tapering a little from the base to the middle, while the distal half widens gradually a little again and then tapers to the acute end. Lobus armatus (*la.*) is long, reaching beyond the processus ventralis; it is somewhat curved, thick at the base and then tapering considerably; the distal half is moderately slender, keeping at least the same thickness to the oblong and tapering terminal part; the obtuse end has a very large hook; on the inner side a large hook is found considerably beyond the middle and a smaller hook near the middle, while the proximal half of the inner margin has about seven small hooks, some of them even shaped as acute, somewhat curved papillæ. Lobus connectens (*lc.*) is, seen from behind (fig. 3*c*), nearly totally overlapped by the lobus terminalis; it is moderately short, thick (fig. 3*d*), tapering to the truncate end which has a couple of hooks, while some minute hooks are found on the distal part of the inner margin. Lobus terminalis (*lt.*) is rather long, curved, its basal third very thick, as it is expanded on the outer side, and the outer margin of this part has about seven small hooks; the distal two-thirds taper to the truncate end which has a very large hook. Lobus inermis (*li.*) is somewhat shorter than lobus connectens but reaches to its end; it is moderately stout at the base but tapers rapidly, so that its distal third is very slender; it has no hooks.

Length cannot be stated with accuracy, as the adult specimens are much curved. The

female is not far from being 62 mm. long, thus about as large as the largest specimen measured by ALCOCK; the male is not inconsiderably shorter than the female.

Remarks. — *S. bisulcatus* is allied to the common North-Atlantic form *S. robustus* Smith, but differs in having the cervical furrow very pronounced on the dorsal surface of the carapace, another shape of the rostrum, proximal half of third joint of the antennulæ less thick, and in some other particulars; the petasma is very different from that in *S. robustus*. As pointed out above, *S. bisulcatus* Faxon (= *S. bisulcatus* Stebbing) is another species, which must keep its older name *S. phorcus* Faxon.

Distribution. — According to ALCOCK this species is common in the Bay of Bengal, the Arabian Sea, and the Andaman Sea; the depths recorded are from 145 to 902 fathoms.

5. *Sergestes Challengeri* H. J. H. Pl. I, figs. 4*a*—4*k*.

1903. *Sergestes Challengeri* H. J. Hansen, Proc. Zool. Soc. London for 1903, vol. I, p. 61, Pl. XII, figs. 2*a*—2*n*.
1913. *Sergestes challengeri* Stanley Kemp, Trans. Linn. Soc. London, Zool. 2. ser., Vol. XVI, pt I, p. 54, Pl. 7, fig. 1.

Stat. 46a. April 7. Lat. 8° 0′.5 S., long. 118 34′.7 E. 1600 m. Deep sea trawl. 1 adult female.
Stat. 89. June 21. Pulu Kaniungan ketjil. 11 m. Shore exploration. 1 immature male.
Stat. 141. Aug. 5. Lat. 1° 0′.4 S., long. 127° 25′.3 E. 1950 m. HENSEN vertical net, from 1500 m. depth to surface. 2 females.
Stat. 143. Aug. 7. Lat. 1° 4′.5 S., long. 127° 52′.6 E. 1454 m. HENSEN vertical net, from 1000 m. depth to surface. 2 young specimens.
Stat. 148. Aug. 10. Lat. 0° 17′.6 S., long. 129° 14′.5 E. 1855 m. HENSEN vertical net, from 1000 m. depth to surface. 1 adult male, 2 immature specimens, and 1 Mastigopus.
Stat. 185. Sept. 12. Lat. 3° 20′ S., long. 127° 22′.9 E. HENSEN vertical net, from 1536 m. to surface. 5 adult males, 4 females, 2 immature specimens.
Stat. 243. Dec. 2. Lat. 4° 30′.2 S., long. 129° 25′ E. HENSEN vertical net, from 1000 m. to surface. 2 young specimens.

a. Adult Specimens. — This species was established on a single mutilated specimen. A large number of luminous organs were pointed out, and no other species with such organs was known. In 1905 STEBBING described an allied species, *S. gloriosus*, from off South Africa, but in this form the luminous organs are still considerably more numerous than in *S. Challengeri*, and the animal is much larger. In the manuscript to the paper on the Sergestidæ from the "Travailleur" and "Talisman" I have described a third species secured by the last-named expedition in the tropical Atlantic; this species, which I name *S. splendens* n. sp., is as large as *S. gloriosus*, viz. about 50 mm. in length, but it differs from *S. gloriosus* and agrees nearly with *S. Challengeri* as to the number of luminous organs. Finally, the "Siboga" has captured many specimens of a fourth species, to be described later on, *S. fulgens* n. sp.; it is about as large as *S. gloriosus* and *S. splendens*, while the largest specimen of *S. Challengeri* hitherto seen is only 35 mm. long, and most of its specimens are less than 30 mm. These four luminous species are very closely allied, in reality very similar in most features; *S. gloriosus* must be the most easy to determine as it has a much higher number of luminous organs on the antennal squama, the sides of the carapace etc. than found in the three other species.

In 1913 Stanley Kemp published, based on about 4 specimens, a supplement to my description of the mutilated specimen of *S. Challengeri*. He was able to describe and figure the eyes, and it may be added that they are somewhat large, seen from above (fig. 4*b*) about as long as the inner margin of the distal joint of the stalk and very considerably broader than the distal part of this joint. His specimens differed somewhat from the 'Challenger' type in the shape and direction of the rostrum, but I have found some variation in this process, and add a drawing (fig. 4*a*) showing its most common shape in the adults. His remarks on two joints in the second pair of maxillipeds is correct. Finally he investigated the number and position of the photophores; he found the 117 organs enumerated by me, and it must be added that he pointed out that the organs on the side of the carapace turn inwards, and according to my observation there are generally 4, sometimes 5 organs in the line on each side of the carapace. Furthermore he found 18 organs on appendages — eye-stalks and the two posterior pairs of thoracic legs — missing in my type, finally in all 4 organs on the three posterior abdominal segments and not observed — probably overlooked — by me. I may here correct a statement in my paper as to the organs on first pair of thoracic legs; each leg has, as stated, 3 organs, but one is placed proximally on the third joint, the two others near each end of fourth joint. As three pairs of appendages have never been examined, it may be added here that third pair of maxillipeds have 4 organs, each placed distally on second to fifth joints; each leg of second and third thoracic pair has 3 organs, viz. 2 on the lower side of third joint, respectively near the base and at the distal end, and a single organ distally on fourth joint. These three pairs of appendages have consequently together 20 organs, which added to the number of organs already known give the result that 159 organs, or, when the sides of the carapace have in all 9 or 10 organs, 160 or 161 organs are found in this species. — It may otherwise be sufficient to refer the zoologist to my earlier description and drawings of *S. Challengeri* as to all external features excepting the third maxillipeds and differences between the two sexes, which are entirely unknown.

Third maxillipeds are not inconsiderably shorter than third pair of legs; the terminal joint is divided into four sub-joints, the first considerably shorter than the second which is somewhat shorter than the third and a little shorter than the fourth.

The antennulæ show strong sexual difference. Third peduncular joint in the female is robust and distinctly deeper than broad; seen from the side and slightly from below (fig. 4*e*) its distal third has the margins nearly parallel, and this part is a little less deep than the proximal half. In the male the third joint is scarcely as long as in the female of the same size but much deeper, and its distal third is below produced into a large triangular part (fig. 4*c*), the distal lower corner of which is a triangular, acute process directed downwards and much forwards; in one specimen the front margin of the produced or expanded part has a smaller triangular tooth above the process mentioned (fig. 4*d*), while in other specimens this tooth is rudimentary or wanting (fig. 4*c*). — The lower antennular flagellum is in the female simple as usual, in the male (fig. 4*c*) its clasping organ is strongly built and characteristic. The upper process from its first joint is seemingly nearly divided into two portions, the proximal one being moderately thick and a little curved with the convex margin upwards, while the distal portion,

which is somewhat shorter and more slender than the proximal, is strongly curved with the convexity downwards and the end acute. Second joint is thick at the base and tapers to the end; its upper margin has about twelve thick setæ, the few proximal of them moderately short, while the others are quite short and towards the end extremely short, more similar to teeth than to setæ; third joint is moderately thick, expanded upwards from base to end; the other joints are slender.

The petasma is very different from those in the preceding species, but so similar to that in the following form, *S. fulgens*, that the outline of the organ in the last-named species (fig. 6*e*) is deemed sufficient for conveying a general idea, while the distal half of pars media in *S. Challengeri* is shown from behind (fig. 4*f*) and from in front (fig. 4*g*). Lamina externa (*la.* in fig. 6*e*) is considerably shorter than processus uncifer (*pu.*), with the outer margin angular beyond the middle, its proximal part concave and the distal part a little convex; processus uncifer is somewhat slender, with its most distal part a little or not widened on the inner side (fig. 4*h*). Processus basalis is somewhat slender, a little curved, distally subacuminate and acute. Pars media is somewhat robust. Processus ventralis (*pv.* in figs. 4*f*—4*g*) is of middle length, moderately thick at the base, from which it tapers nearly gradually to the acute end, and its distal part is curved much outwards. Lobus armatus (*la.*) is long and thick; it has an extremely large hook on the inner side somewhat from the end, which is cut off and has a large hook, while about nine hooks, the six distal moderately large, the others small, are seen as a very oblong group on the posterior side near the outer margin. Lobus connectens (*lc.*) is scarcely half as long as lobus armatus, very thick and besides much expanded towards the end, which has a long terminal margin rather deeply excavated somewhat nearer its inner than its outer end, so that the most distal part of the lobe is divided into two short and thick secondary lobes, the outer considerably thicker than the inner; the distal margin of the inner secondary lobe has three large hooks, the distal and outer margin of the outer lobe has about seven smaller hooks, and besides the entire lobe has on the front side (fig. 4*g*) a median longitudinal row of hooks and about three hooks towards the outer margin somewhat before the end. Lobus terminalis (*lt.*), which is almost as long as lobus armatus, is very peculiar and without hooks; its proximal part is directed essentially inwards, and then it suddenly is bent, directed forwards and distally curved outwards; its distal end is in the specimen figured deeply concave with each lateral corner produced into a triangular, acute process, but this end varies much individually, as sometimes only one produced and acute lateral angle is found, sometimes the end is feebly emarginate and generally it is rounded (as in *S. fulgens*, fig. 6*f*). Where the subproximal bend is found on the lobe, the angle protrudes less or more, and from comparison with the organ in *S. splendens* n. sp. (Atlantic) I am induced to think that this protruding part is a quite rudimentary lobus inermis. Finally we find on the front side of pars media (fig. 4*g*) near the origin of processus ventralis two lobi accessorii (*lac.*), the outer slender and rather long with a large hook on the end, the inner lobe scarcely half as long but much thicker than the other, with about six hooks on its anterior side.

Length of a large adult male 31.5 mm., of a large female 35 mm.

b. Younger Stages. — One of the smallest specimens with black eyes is scarcely

17 mm. long. The eyes are distinctly smaller with their stalks proportionately longer, and the rostrum is less produced than in the adults, but the most interesting difference is that fewer photophores are found. These organs are well developed on the lower side of the thorax, but on each side of the carapace only one organ exists, while the antennal squama, which is easily examined, has only two organs; the more special, very difficult search for photophores has not been undertaken. — One of the largest specimens with the thick outer layer of the eyes yellowish, is 13 mm. long; it is a transition-stage between the real *Mastigopus* and the young specimen with black eyes just mentioned. It differs in having the antennular peduncles (fig. 4*i*) conspicuously less robust and the eyes considerably smaller with their stalks longer; the rostrum has a small, acute angle above, while its distal part is slender, acute; the two posterior pairs of thoracic legs are less developed, and sixth abdominal segment has its posterior upper angle produced into a very small spine. Several well developed photophores are found on the lower side of the thorax; second maxilliped has at least four organs, and an organ is found on the lower side of the eye-stalks near the eye, but no organ could be discovered on third maxillipeds, on the thoracic legs, the sides of the carapace and above all on the lower side of the antennal squamæ. — Figs. 4*l* and 4*k* represent respectively the anterior part of the body and the exopod of left uropod of a real *Mastigopus* measuring 12.3 mm. in length. It is seen that the rostrum (*a.*) is small with a small upper tooth, while the eye-stalks are long, so that the eyes, which are considerably larger than in the stage just mentioned, are situated above the articulation between first and second joint of the antennular peduncle; this peduncle is as usual in *Mastigopus*-forms rather slender; fifth and sixth abdominal segments each with a small spine on the upper posterior angle; the ciliated part of the outer margin of the exopod of the uropod (as usual in this sub-group of *Sergestes*) distinctly longer in proportion to the naked part than in the adult; finally it was impossible to find any photophores on the ventral side of the thorax or on second maxilliped, and they are probably entirely wanting.

Remarks. The differences between *S. Challengeri*, *S. splendens* n. sp. (from the Atlantic) and *S. fulgens* are mentioned in the description, with remarks, of the last-named form.

Distribution. — The 'Challenger' specimen was taken at "Lat. 19° 9′.35 S., long. 179° 41′.50 E.; off Matuku, Fiji Islands; depth 315 fathoms". KEMP's specimens were gathered in the western part of the Indian Ocean, viz. at lat. 10° 27′ S., long. 51° 17′ E., 800—0 and 1000—0 fathoms, and "6 miles N. N.W. of Desroches Atoll", 200 to 0 fathoms.

Sergestes sp. Pl. I, fig. 5*a*.

Stat. 100. June 29. Lat. 6° 11′ N., long. 120° 37′.5 E. 450 m. Dredge. 1 adult male.

The single male, which measures 32.5 mm. in length, cannot belong to *S. Challengeri*; it is very closely allied to this species, agreeing with it in the petasma and every other particular, but the third joint of the antennular peduncle and the lower flagellum are very different. The distal part of that third joint (fig. 5*a*) is slightly expanded downwards, but its lower part is produced considerably forwards, with its terminal inferior corner cut off obliquely and bearing a long and extremely thick, acute seta or spine. The lower flagellum differs

extremely from the clasping organ in the male *S. Challengeri* or *S. fulgens*, as it is more similar to the flagellum in a female, from which it differs only in having the second joint (fig. 5*a*) longer and above at the end produced into a small, obtuse process. Third joint of the peduncle and the proximal joint of the lower flagellum are rather similar to the same parts in the Atlantic form *S. splendens*, through showing differences in two or three small particulars; the petasma agrees with that in *S. Challengeri*, and differs from *S. splendens* in a few small features. The specimen is mentioned here, as future investigators with a richer material of these luminous forms of *Sergestes* ought to keep outlook in order to solve the difficulties.

6. *Sergestes fulgens* n. sp. Pl. I, figs. 6*a*—6*g*.

Stat. 312. Febr. 14. Lat. 8° 19′ S., long. 117° 41′ E. Saleh-bay, North coast of Sumbawa. 274 m. Trawl. 22 specimens, 16 of which are adult males.

This species is so closely allied to *S. Challengeri* that a half-grown female can scarcely with absolute certainty be distinguished from an adult female of the last-named species excepting by the fact, that in the latter the antepenultimate thoracic segment has its lower surface between the coxæ adorned with keels and protuberances, which are not found in the immature *S. fulgens*.

S. fulgens is much larger and looks proportionately more robust than *S. Challengeri*. The rostrum (fig. 6*a*) is distinctly longer than deep, thus somewhat more produced than in *S. Challengeri*. The eyes are seemingly a little larger in proportion to first joint of the antennular peduncles, and a little longer in proportion to their stalks than in *S. Challengeri*. The terminal joint of third maxillipeds (fig. 6*d*) is as in the last-named species divided into four sub-joints, each of the two distal conspicuously longer than the second and especially than the first, but third sub-joint is sometimes, but scarcely always, more or less distinctly subdivided into two joints, as shown in the figure. By far the best character between *S. fulgens* and the other luminous forms is the shape of third joint in the antennular peduncle in the male. This joint (fig. 6*b*) is extremely characteristic and shows no variation worth mentioning in the numerous adult males examined. The distal third of the joint is on the lower side produced strongly downwards, somewhat forwards and a little inwards as a plate which has a very deep and rounded terminal incision so that both the lower anterior and the posterior corner of the plate have each a long process; the anterior process is straight and considerably longer than the posterior, a little curved process, and both processes have the end obtuse. The clasping organ of the lower flagellum (fig. 6*c*) is shaped nearly as in *S. Challengeri*, but the curious setæ along the upper margin of second joint are about sixteen, and the most proximal setæ are longer, the most distal ones thicker than in *S. Challengeri*. — The carapace has on each side either 6 or 5 photophores in a row.

The petasma (figs. 6*e*—6*g*) is so similar to that in *S. Challengeri* described above that some remarks may be sufficient. The distal part of processus uncifer (*pu.*) is conspicuously expanded inwards. The hooks on the posterior side of lobus armatus (*la.*) near its outer margin are smaller and somewhat more numerous than in *S. Challengeri*. Lobus connectens (*lc.*) has the distal margin less deeply curved, the outer lobe more narrow, the inner broader than in

the preceding species, besides the hooks along the outer and the distal margins are a little smaller and a little more numerous, and the hooks in the longitudinal row on the anterior side (fig. 6*g*) are considerably smaller. The inner proximal bend on lobus terminalis (*lt.*) is more produced almost as a low and broad protuberance. The inner one of the accessory lobes (fig. 6*g*, *lac.*) is short and thick.

Remarks. — It may be seen that the two really valuable specific differences between *S. fulgens* and *S. Challengeri* are the size of the adults and the shape of third joint in the male antennular peduncles. But this joint differs strongly in the two forms, and as no intermediate form has been observed the character must be of specific value. In my description of *S. splendens* (manuscript on the 'Talisman' Sergestidæ) I have pointed out that the same third joint in this species differs rather little from that in the female, as it has no process directed downwards, furthermore that the lower antennular flagellum in the male has its proximal part somewhat feebly thickened with a rather small and distally rounded protuberance on second joint, thus the whole structure differing widely from what is found in *S. Challengeri* and *S. fulgens*, but somewhat similar to the above-mentioned indeterminable male from "Siboga" Stat. 100. In the French paper I have also described and figured the ventral side of the four posterior thoracic segments of the female, showing the adornment of the antepenultimate segment between the coxæ, and pointing out that a similar structure is found in *S. Challengeri* and *S. fulgens*, but that in these the keels, and especially the two posterior protuberances, are less developed than in *S. splendens*, differences not easy to use as characters and scarcely possible to figure accurately. Finally the petasma of *S. fulgens* differs from that in *S. splendens* in some minor particulars, among which those found in the shape of lobus terminalis are perhaps the most important.

7. *Sergestes seminudus* n. sp. Pl. I, figs. 7*a*—7*c*; Pl. II, figs. 1*a*—1*f*.

Stat. 66. May 7—8. Bank between islands of Bahuluwang and Tambolungan, south of Saleyer. 8—10 m. Plankton. 6 *Mastigopus*.
Stat. 144. August 7—9. Anchorage north of Salomakiëe-(Damar-)island. 45 m. Plankton. 6 *Mastigopus*.
Stat. 148. Aug. 10. Lat. 0° 17′.6 S., long. 129° 14′.5 E. HENSEN vertical net, from 1000 m. depth to surface. 4 specimens (1 is an adult male).
Stat. 157. Aug. 15—16. Lat. 0° 32′.9 S., long. 130° 14′.6 E. 45 m. Plankton. 1 *Mastigopus*.
Stat. 168. Aug. 22—23. Anchorage North of Sabuda-island. 63 m. Surface. 1 *Mastigopus*.
Stat. 177a. Sept. 1. Lat. 2° 30′ S., long. 129° 28′ E. Townet. 1 *Mastigopus*, 3 *Acanthosoma*.
Stat. 185. Sept. 12. Lat. 3° 20′ S., long. 127° 22′.9 E. Manipa-strait. HENSEN vertical net, from 1536 m. to surface. 3 males, 1 large female.
Stat. 189a. Sept. 12. Lat. 2° 22′ S., long. 126° 46′ E. Townet. 1 *Mastigopus*.
Stat. 194–197. Sept. 15. Lat. 1° 55′–1° 45′.3 S., long. 126° 39′–127° 8′.3 E. Plankton. 1 *Mastigopus*.
Stat. 203. Sept. 19. Lat. 3° 32′.5 S., long. 124° 15′.5 E. Vertical net from 1500 m. depth to surface. 1 young specimen, 1 *Mastigopus*.
Stat. 223. Nov. 6. Lat. 5° 44′.7 S., long. 126° 27′.3 E. Surface. 1 *Mastigopus*.
Stat. 230. Nov. 14. Lat. 3° 58′ S., long. 128° 20′ E. HENSEN vertical net, from a depth of 2000 m. to surface. 1 adult male.
Stat. 276. Jan. 9. Lat. 6° 47′.5 S., long. 128° 40′.5 E. HENSEN vertical net, from 750 m. to surface. 1 *Mastigopus*.

a. Adult Specimens (Pl. I, figs. 7*a*—7*c*; Pl. II, figs. 1*a*—1*b*). — Very similar to *S. corniculum* Kr. Both species together constitute a sharply defined tribe of group I of *Sergestes*. Here may be given a somewhat detailed description of *S. seminudus*, but as it is so similar to *S. corniculum* that it will be difficult to point out any valid specific difference between them excepting in the male petasma, it may be sufficient to refer to my figures of various parts of *S. corniculum* to be found in the future paper on the Sergestidæ from the French expeditions.

The animal is slender, with a considerable distance between the mouth and the insertion of the eye-stalks. The carapace is considerably compressed; its rostrum is small or even very small, somewhat or only a little produced forwards, with the distal parts of the upper and the lower margin strongly converging and the end acute or produced into a minute, acute tooth. A supra-ocular spine is wanting, but its crest is very conspicuous; the hepatic spine is small but very distinct. The gastro-hepatic groove is deep, and from its postero-lateral angle a very conspicuous keel runs forward to the antenna. The upper and the anterior margin of the branchial area is limited by a deep groove, and along the upper margin runs a strong keel, while the cervical groove above the front part of the branchial area is nearly or quite indistinct. The abdomen scarcely affords any valuable character; its sixth segment is a little less than twice as long as deep.

The eyes are somewhat small, conspicuously shorter but much broader than the slender and a little elongate distal joint of their stalks; on the inner margin of the stalk a little behind the cornea is seen a rounded protuberance which sometimes is about as high as broad, most frequently lower than broad. The antennular peduncles are long, about two-thirds as long as the dorsal line of the carapace; first joint has its distal half narrower than in the preceding species; second and especially third joint is slender; third joint is considerably shorter than the first, somewhat longer than the second, and slightly thicker in the male than in the female. The clasping organ on lower male flagellum is slender and shaped as in *S. corniculum*. The antennal squama tapers considerably towards the rather narrow, rounded end, and the tooth on the outer angle is very small; squama reaches the middle of third antennular joint. Third pair of maxillipeds are a little shorter than third pair of legs, but the three proximal joints are broader than in these legs; the terminal joint (fig. 1*a*) is divided into 8 or 7 subjoints (I have found both numbers in specimens from the same locality), but the interpretation is that the joint is divided into 4 subjoints gradually distinctly shorter from the first to the fourth, and that each of the three distal subjoints and sometimes besides the first subjoint is again subdivided into two joints. Fig. 1*b* exhibits the long and thin terminal joint of first pair of legs. The exopod of the uropods is about five times as long as broad and tapers from a little from the base to the narrow end; scarcely two-thirds of its outer margin is ciliated, and there is no marginal tooth.

The branchiæ are somewhat similar to those in *S. arcticus*; first branchia above third pair of legs is conspicuously more than twice as long as the second, which is about as long as the second branchia above fourth legs, while the first branchia above fourth legs is somewhat or considerably longer, and more than half as long as first branchia above third legs.

The petasma (figs. 7*a*—7*c*) shows interesting features. Lamina externa (*lam.*) is distinctly

shorter than processus uncifer (*pu.*); the proximal part of its outer margin is a little concave and considerably longer than the distal part; processus uncifer is somewhat slender. Processus basalis (*pb.*) is of moderate length, conical, acute. Pars media is moderately slender. Processus ventralis (*pv.*) is rather long, at the base extremely broad and tapers rapidly so that it in more of half of the length is of moderate thickness; at the end it is expanded and cut off with the terminal margin obliquely concave and the distal interior corner produced as a triangular, acute process; in front along the terminal margin is found 8 triangular teeth. Lobus armatus (*la.*) projects beyond the processus ventralis; it is somewhat thick at the base, decreases towards the obtuse end and is straight or only a little curved; its whole inner margin has a row with about 13 hooks, the small terminal one included. Lobus connectens (*lc.*) is somewhat small, oblong triangular, directed outwards with about 8 hooks on the distal half of its anterior side. Lobus terminalis (*lt.*) is moderately short, not decreasing in breadth to the obliquely rounded end and curved outwards; its terminal part has a good number of hooks especially on the margin and the front side. Lobus inermis (*li.*) is considerably longer than lobus terminalis, directed forwards and somewhat inwards, tapers from rather near the base to the narrow subacute end, and it has no hooks. — (The thelycum differs much from that in *S. fulgens* or *S. Challengeri*, but having only a single full-grown female it was found very difficult to draw a good figure, and without a figure a description of the protuberances and impressions has scarcely any value).

Length of the adult female 46 mm., of a large male 37 mm.

b. Mastigopus-Stages. — These larvæ are scarcely discernible from those of *S. corniculum* Kr., which has been established on such larvæ measuring according to KRÖYER scarcely 13 mm. KRÖYER and BATE published descriptions and figures of such forms. In 1896 I described a young stage measuring 6.4 mm. in length; in 1903 I pointed out that *S. longirostris* Bate is a very young *Mastigopus* of the same species. The *Mastigopus*-stages of *S. corniculum* and and *S. seminudus* are distinguished from those of all other species of Group I by the exopod of the uropods, as the ciliated part of the outer margin occupies from a little more than half to about three-fifths of its length; in the youngest specimens the end of the naked portion has a well developed spine, and this spine is gradually reduced in size according to age, and disappears in large specimens. The largest *Mastigopus* in the "Siboga" material is 12 mm. long and has the rostral process very thin and moderately short; one of the smallest specimens measures 4.3 mm. not including the very long rostral process which reaches the middle of the eyes; both specimens are from Stat. 144. The descriptions by KRÖYER, BATE, and myself, and the figures published by KRÖYER, BATE, and CHUN of various stages of the *Mastigopus* of *S. corniculum* (and the very young stage named *S. longirostris* Bate) may be sufficient for the present.

c. Acanthosoma (or *Mysis*-)Stage (Pl. II, figs. 1*c*—1*f*). — Together with a single *Mastigopus* 3 specimens of *Acanthosoma* were found in the Plankton material, and for various reasons, viz. length of rostrum, shape of the eyes and of the exopod on the uropods, they must belong to this species. The rostrum (fig. 1*c*) is about half as long again as the carapace in the median line, with many fine spines. The carapace (figs. 1*c*—1*d*) has four pairs of long

processes; the first pair are in reality the supra-orbital spines which are nearly as long as the eye-stalks and have several fine spiniform processes. Second pair project from the antero-lateral angles; each process has about six long or very long branches, and on the distal part some small spines. Third pair a little behind second pair but much higher upwards on the vaulted carapace, and these processes are probably homologous with the gastro-hepatic spines; fourth pair originate considerably behind the middle of the carapace somewhat above its lateral margin; each process of these two pairs has about four moderately long branches on its proximal third, and some spines on the distal portion. Each of the five anterior abdominal segments (figs. 1*c* and 1*e*) has three very long processes, one dorsal and one on each lateral margin, and these processes are spiniferous and with branches towards their base; sixth segment has only the dorsal process. Distal joint of the eye-stalks about half as long as the median line of the carapace; the eyes are large (fig. 1*d*), considerably deeper than broad and placed not quite vertical on the stalk. The antennular peduncles are not much shorter than the carapace, two-jointed, with first joint more than three times as long as the second; upper flagellum about half as long as the peduncle, two-jointed, while the lower flagellum is a mere knot. The antennal squama (*sq.*) is very narrow and a little longer than first antennular joint, with the distal marginal spine extremely long and projecting uncommonly remote from the end of the squama. Third maxillipeds and all five pairs of thoracic legs with both endopod and exopod; in the two posterior pairs the exopod is about twice as long as the endopod. All pleopods are very conspicuous, each consisting of a single, very oblong joint. The uropods (fig. 1*f*) are long and very slender; the peduncle has the outer angle produced into a long, spiniform process; the exopod has the ciliated part of the outer margin a little more than twice as long as the naked part, and at the end of the latter is found a somewhat long, spiniform process. The telson is peculiarly shaped; its proximal third is broad, subrectangular, with a spine at each postero-lateral angle; then it tapers rapidly to the middle, while its terminal part is again a little broader and deeply divided into two branches; a pair of dorsal spines are seen considerably from the end, and each branch has a small spine above and terminates in a very long and strong spine. — Length without rostrum 2.5—3.2 mm.

Remarks. — As already stated, the only valid specific differences between *S. seminudus* and *S. corniculum* hitherto found are in the structure of the male petasma. The males of the two species are instantly separated by the shape and equipment of the lobus armatus, which in *S. seminudus* is more slender with hooks along the whole inner margin and no hook near the distal end of the anterior side, while in *S. corniculum* the lobe is proximally considerably thicker with about three conspicuous hooks along the proximal part of the inner margin, some quite small hooks at the terminal margin, an extremely big hook on the front side near the end, but no hooks along the distal half of the inner margin to near the end. Furthermore lobus connectens has in *S. corniculum* no hooks on its anterior side, the lobus terminalis a somewhat other shape than in *S. seminudus*, and processus ventralis a higher number of teeth at the distal margin. Judging from the size of adult specimens of both species *S. corniculum* is somewhat to considerably larger than *S. seminudus*.

A male specimen from the Bay of Bengal received from the Museum in Calcutta as

S. rubro-guttatus Wood-Mason belongs to *S. corniculum*; which consequently is found at least in the more western part of the Indian Ocean. *S. corniculum* Kr., which was established on specimens in the *Mastigopus*-stage from the tropical Atlantic, is common at least in the northern subtropical area of that ocean, and judging from its *Mastigopus* it is known from lat. 42° N. to lat. 30° S. In 1896 I wrote that I had seen specimens of *S. corniculum* from the Indian Ocean and ranging into the Pacific to the Matelota island and to lat. 16° 70′ N., long. 132° E.; these specimens were either *Mastigopus*-forms or quite young animals with black eyes, but as the adult males from the "Siboga" belong to the hitherto unknown species *S. seminudus*, and as I think it nearly impossible to separate young specimens or *Mastigopus*-stages of this species from those of *S. corniculum*, the statements quoted on the distribution in the Indian Ocean and the Pacific show only the distribution of this tribe consisting of two species, and at least the major part or perhaps nearly all of the specimens in question belong in all probability to *S. seminudus*.

Species of Group II.

8. *Sergestes orientalis* n. sp. Pl. II, figs. 2*a*—2*q*.

Stat. 37. March 30—31. Sailus Ketjil, Paternoster islands. 27 m. and less. Surface. 5 *Mastigopus*.
Stat. 40. April 2. Anchorage off Pulu Kawassang, Paternoster islands. 12 m. Townet. 2 *Mastigopus*.
Stat. 66. May 7—8. Bank between islands of Bahuluwang and Tambolungan, south of Saleyer. 8—10 m. Plankton. 1 young specimen, 7 *Mastigopus*.
Stat. 96. June 27. South-east side of Pearl bank, Sulu-archipelago. 15 m. Townet, surface. 2 *Mastigopus*, 1 *Acanthosoma*, 1 *Elaphocaris*.
Stat. 106. July 4. Anchorage off Kapul-island, Sulu-archipelago. 13 m. 1 *Mastigopus*.
Stat. 118. July 13. Lat. 1° 38′ N., long. 124° 28′.2 E. HENSEN vertical net, from 900 m. to surface. 1 specimen.
Stat. 125. July 18—19. Anchorage off Sawan, Siau-island. 27 m. Plankton. 1 *Mastigopus*.
Stat. 128. July 22. Lat. 4° 27′ N., long. 125° 25′.7 E. 1645 m. HENSEN vertical net, from 700 m. to surface. 2 *Mastigopus*.
Stat. 131—133. July 25. About lat. 5° 56′.7 N., long. 126° 25′ E. Plankton. 1 *Mastigopus*.
Stat. 141. August 5. Lat. 1° 0′.4 S., long. 127° 25′.3 E. 1950 m. HENSEN vertical net, from 1500 m. depth to surface. 1 specimen. 1 *Mastigopus*.
Stat. 143. Aug. 7. Lat. 1° 4′.5 S., long. 127° 52′.6 E. 1454 m. HENSEN vertical net, from 1000 m. to surface. 4 specimens, 1 *Mastigopus*.
Stat. 144. Aug. 7—9. Anchorage North of Salomakiëe-(Damar-)island. 45 m. Plankton. 4 *Mastigopus*.
Stat. 146. Aug. 9. Lat. 0° 36′ S., long. 128° 32′.7 E. 512 m. Townet, surface. 1 specimen, 1 *Mastigopus*.
Stat. 148. Aug. 10. Lat. 0° 17′.6 S., long. 129° 14′.5 E. 1855 m. HENSEN vertical net, from 1000 m. depth to surface. 8 specimens, 1 *Mastigopus*.
Stat. 157. Aug. 15—16. Lat. 0° 32′.9 S., long. 130° 14′.6 E. 45 m. Plankton. 6 *Mastigopus*.
Stat. 168. Aug. 22—23. Anchorage North of Sabuda-island. 63 m. Townet, surface. 2 *Mastigopus*.
Stat. 172. Aug. 26—28. Gisser, anchorage between this island and Ceram-Laut. 18 m. Plankton. 1 *Mastigopus*.
Stat. 177a. Sept. 1. Lat. 2° 30′ S., long. 129° 28′ E. Townet. 1 young specimen, 20 *Mastigopus* and *Acanthosoma*.
Stat. 185. Sept. 12. Lat. 3° 20′ S., long. 127° 22′.9 E. HENSEN vertical net, from 1536 m. depth to surface. 4 specimens, 4 *Mastigopus*.

Stat. 189a. Sept. 12. Lat. 2° 22′ S., long. 126° 46′ E. Townet. 2 *Mastigopus.*

Stat. 194—197. Sept. 15. Lat. 1° 53′.5—1° 45′.3 S., long. 126° 39′—127° 8′.3 E. Plankton. 3 *Mastigopus.*

Stat. 203. Sept. 19. Lat. 3° 32′.5 S., long. 124° 15′.5 E. HENSEN vertical net, from 1500 m. depth to surface. 8 specimens, 1 *Mastigopus*, 1 *Acanthosoma.*

Stat. 206 or 207. Sept. 21. Buton-strait. Surface. 3 *Mastigopus.*

Stat. 220. Nov. 1—3. Anchorage off Pasir Pandjang, west coast of Binongka. 278 m. Townet, surface. 1 *Mastigopus.*

Stat. 225. Nov. 8. 5700 m. N. 279° E. from Southpoint of South-Lucipara-island. 894 m. Horizontal cylinder. 1 young specimen, 1 *Mastigopus.*

Stat. 230. Nov. 14. Lat. 3° 58′ S., long. 128° 20′ E. HENSEN vertical net, from 2000 m. depth to surface. 7 specimens.

Stat. 245. Dec. 3. Lat. 4° 16.5 S., long. 130° 15′.8 E. Townet. 7 specimens.

a. Adult Specimens (Pl. II, figs. 2*a*—2*k*). — Closely allied and similar to *S. Edwardsii.* The carapace is moderately compressed; its rostrum is rather short, directed forwards and somewhat upwards, nearly obliquely triangular, acute and even acuminate, as the distal part of both the upper and the lower margin is a little concave. The supra-orbital spines are somewhat small, acute; the hepatic spines well developed. The gastro-hepatic groove is well developed, the cervical groove not discernible. The eyes are somewhat small, scarcely depressed, only a little broader than the stalk; the stalk is rather long in proportion to the eyes, as the outer margin of its distal joint is about half as long again as the eyes. The peduncles of the antennulæ are somewhat long; first joint moderately narrow with the distal half of the outer margin convex; second joint is rather slender, a little shorter than the third joint which is slender, similar in both sexes and about as long as the first. The lower flagellum of the male with its clasping organ is shown in fig. 2*b* from the outer side; a description is scarcely needed, but it may be remarked that the very long, strong and much curved spiniform process reaches about to the middle of the 6-jointed part of the flagellum beyond the base of the process. The antennal squama reaches beyond the middle of third antennular joint; it tapers considerably to the narrow end so that the terminal margin is quite short, while the outer terminal spine is very distinct. Third pair of maxillipeds is very long, a little more than twice as long as the carapace, somewhat more than two and a half times as long as first thoracic legs and more than half as long again as third pair of thoracic legs; the four proximal joints are much thickened, third and especially fourth joint besides depressed so that the latter joint, seen from above, is considerably broader than visible on fig. 2*c*, and this joint has about a dozen fine bristles of very different length along the inner margin (not visible on the figure) and some five short bristles along the outer margin; fifth and sixth joints are much depressed — in reality compressed but turned so that they look as depressed — with the outer and inner margins nearly parallel; fifth joint has about its distal fourth cut off as a subjoint, its inner margin has a number of fine bristles and three long, moderately slender spines, and on the lower surface near the outer margin a smaller number of bristles. Sixth joint is divided into 4 subjoints, the two proximal distinctly longer than the two others, and the second a little longer than the first, and each of the two distal subjoints is again subdivided into two joints subequal in length; thus in all 6 subjoints are found. Sixth joint has 2 spines on the end, the

inner long and strong, the other thinner and distinctly or very considerably shorter; on the inner margin first and second subjoints have each on the end a very long and strong spine, fourth subjoint a considerably smaller spine; on the inner margin of all subjoints together is found in the leg exhibited (fig. 2*c*, *a*.) in all 37 spines — the terminal not included — extremely different in size and several among them very small; on the lower side near the outer margin is found a long, thin spine near the end of first and second subjoints, and sometimes a corresponding but quite small spine is observed on fourth subjoint. The thoracic legs are slender; first pair (figs. 2*d* and 2*e*), as already stated, small, with a conspicuous, oblong, curved, acute tooth or robust spiniform process on the dorsal side of third joint, and the terminal joint not subdivided. Second pair have on the dorsal side of third joint a curved acute process which is longer than in first pair; third pair, when stretched forwards, reach about the end of the antennular peduncle. Fourth pair (fig. 2*f*) is a little shorter than the first, with the two distal joints somewhat narrow; fifth pair is unusually short, and their two distal joints narrow with rather few natatory ciliæ. The exopod of the uropods tapers from somewhat from the base to the narrowly rounded end; its outer margin is ciliated in the whole length and feebly concave from somewhat from the base to the end.

The branchiæ above the thoracic legs are long; above third pair a branchia and a lamella; above fourth pair two branchiæ, the first slightly shorter than that above third pair, the second somewhat shorter and considerably narrower than the first, but of the same regular, oblong shape and very well developed.

The petasma (figs. 2*g*—2*i* and fig. 2*k*) differs extremely from that in any species of group I. Pars externa is small, its lamina (*lam*.) is very oblong, more than half as long again as broad and broadest in front, with the posterior two-thirds of the outer margin concave and the anterior third convex; processus uncifer (*pu*.) is reduced, conspicuously less than half as long as lamina externa, and its terminal part rounded without any incision. Pars media is extremely broad; processus basalis is a large, triangular plate a little broader than long with the end narrowly rounded. Processus ventralis (*pv*.) is quite minute, oblong-triangular, with the distal part very narrow. Lobus armatus (*la*.) is short, extremely broad and divided by a short but very broad terminal incision into two diverging branches; several small hooks are observed at the inner margin of the inner branch, and numerous small hooks on the anterior side and at the end of the outer branch. Lobus connectens (*lc*.) is moderately short and very thick with the end broadly rounded; it has many conspicuous hooks on the posterior side and along the inner margin. Lobus terminalis (*lt*.) is moderately short, very slender, subcylindrical, with a single very large hook on the obtuse end. Lobus inermis (*li*.) is larger than any of the other lobes, directed forwards and much inwards, very thick to the broad, very obtuse end, and without hooks. At the base of lobus inermis is found a very slender lobe terminating in a very large hook; as no corresponding ramification is found in the preceding forms it is named lobus accessorius (*lac*.). Pars astringens (*a*.) is small, but the coupling hooks along its inner margin are well developed.

Length of a large male 19 mm., of a male from the Chinese Sea 20 mm., of a female 16 mm.

b. Mastigopus-Stages (figs. 2*l*—2*n*). — The stages of this species are scarcely discernible from those of *S. Edwardsii*, which have been described and figured by KRÖYER and BATE as *S. oculatus* Kr., and a young stage by KRÖYER as *S. brachyorrhos* Kr.; besides these stages were mentioned by me in 1896. A large *Mastigopus* (from Stat. 144) is 10.8 mm. long; the long eye-stalks with the large, very oblique eyes are in the main as in the much younger animal shown in fig. 2*l*; the rostrum is considerably produced, proportionately about twice as long as in the adult; the terminal joint of third pair of maxillipeds (fig. 2*m*) is divided into 4 subjoints, and each of the two distal subjoints shows a feeble transverse line, thus a rudimentary division into two joints, while the equipment with spines of all 6 subjoints differs widely from what is found in the adult. The abdominal segments without dorsal spines, excepting sixth segment which has a minute spine on the upper terminal angle. The outer margin of the exopod of the uropods ciliated nearly to the base, thus almost as in the adult; telson long and nearly as in the adult. — Fig. 2*l* exhibits the carapace with eyes, antennulæ and antennal squama of a small specimen measuring (without rostrum) 4.3 mm. length; it is seen that the rostral process is more than one-third as long as the carapace in the median line, and that the supra-ocular and hepatic spines are rather long. The long eye-stalks with the very oblique eyes show the shape peculiar to this form. The antennular peduncles are only two-jointed, the first joint is long, very slender from the end to a little from the base, and this basal part is widened and produced into a triangular, acute process; the lower flagellum is a minute joint. The abdomen has in this specimen a very distinct spine at the upper hind angle of each of the three posterior segments; the telson is short, only a little longer than in the still younger form mentioned below and similar in shape; the outer margin of the exopod of the uropods is ciliated in $^{8}/_{9}$ of its length, and at the end of the short, naked basal part a quite rudimentary spine is seen. — A still younger *Mastigopus* is only 3.3 mm. (rostrum not included); its rostrum and the supra-ocular and hepatic spines are still longer than in the preceding larva; second abdominal segment has a minute dorsal spine considerably before the end, third and fourth segments each a moderately long dorsal spine a little from the end, fifth and sixth segments each a similar spine from the hind angle. The telson is short (fig. 2*n*), seen from above shaped in the main as in the *Acanthosoma*-stage (fig. 2*q*), consequently broad from the base to considerably beyond the middle, then somewhat narrowed, with each posterior angle produced in a short process terminating in a spine; the outer margin of the exopod of the uropods (fig. 2*n*) is ciliated in scarcely $^{5}/_{6}$ of its length, and the naked part terminates in a spine.

c. Acanthosoma- (or *Mysis-*)Stage (figs. 2*o*—2*q*). This stage, which has never been described, is somewhat similar to that of *S. seminudus*, but differs in various features. The rostrum is about as long as the median line of the carapace, with a number of fine spines. The carapace has the same four pairs of processes as in *S. seminudus* and besides a process posteriorly in the median line. The first pair of processes, in reality the supra-orbital spines, are very long, more than half as long as the rostrum, curved, with some fine spines. The three other pairs are not half as long as the first pair; the two lateral pairs have lateral branches near the base and more distally a few fine spines. The posterior process originates at the hind margin of the carapace, is directed forwards and a little curved, about half as long as the

rostrum. The abdominal segments have the same dorsal and lateral processes as in *S. seminudus*, but first segment has besides (fig. 2*o*) a pair of sublateral, rather short and subcylindrical protuberances a little from its anterior end. The eye-stalks are distinctly shorter than in the *Mastigopus* shown in fig. 2*l*, but thicker towards the large, thick, oblique eyes. The antennular peduncles (a^1) without any articulation; the upper flagellum conspicuously less than half as long as the peduncle, unjointed, and the lower flagellum short though much longer than in *S. seminudus*. The antennal squama (*sq.*) very narrow, with the distal marginal spine extremely long and originating proportionately considerably behind the end of the squama. The telson (fig. 2*q*) is short, scarcely twice as long as broad; its distal part is narrowed and the end strongly emarginate, with a spine from each much produced lateral angle, but no other spines are found on the telson. The exopod of the uropods has its outer margin ciliated in somewhat more than $^3/_4$ or in almost $^4/_5$ of its length, and a rather long spine is seen at the end of the naked part. Length without rostrum 3 mm.

Remarks. — *S. orientalis* is so closely allied to *S. Edwardsii* Kr. that to begin with I had not separated it, but a closer examination gave the result that the petasma differs considerably from that in the Atlantic species. As the petasma in the latter form was unknown I thought it nearly necessary to insert a drawing (Pl. II, fig. 3*a*) for comparison. It is seen that in *S. Edwardsii* processus ventralis (*pv.*) is still much smaller and subcylindrical; the outer branch of lobus armatus (*la.*) is long and moderately slender, and the long lobus inermis (*li.*) is longer and only half as thick as in *S. orientalis*. It may be noted that I have inspected the petasma in some specimens of both species and found the differences constant. I have not been able to find other absolutely valid specific differences between the two forms; yet it may be mentioned that *S. Edwardsii* is frequently somewhat larger than *S. orientalis*, that the two terminal spines on sixth joint of third maxillipeds are subequal in length and frequently in thickness in *S. Edwardsii*, while in *S. orientalis* they differ generally more conspicuously in size, and in some specimens the spine on the angle is twice as long as the other; furthermore fourth subjoint of sixth joint in third pair of maxillipeds has in *S. Edwardsii* a moderately or rather long spine on the lower side near the outer margin, while in *S. orientalis* this spine is either quite short or wanting.

Adult and subadult specimens of *S. Edwardsii* and *S. orientalis* differ from all other species of group II in having sixth joint of third pair of maxillipeds divided into 6 subjoints, while all the other species hitherto known have only 4 or 5 subjoints, and besides in having the entire outer margin of the exopod of the uropods ciliated, which is not the case in any other species of the genus.

Distribution. — The Copenhagen Museum possesses male specimens of *S. orientalis* from a place a little south-east off South Africa, and from the Chinese Sea at lat. 19° 14′ N., long. 116° 6′ E. (Capt. Andréa). No male of this species has been taken in the Atlantic, while *S. Edwardsii* has not been discovered in the Indian Ocean or the Pacific.

Sicyonella Borradaile (*Aphareocaris* Calm.).

This characteristic genus has been somewhat curiously treated. In 1875 the Russian zoologist Paulson established the genus *Aphareus* on a single species, *A. inermis* Pauls., from the Red Sea; it was referred to the family Penæidæ. As Paulson's paper is not only rare but published in the Russian language, G. Nobili in 1906 fortunately translated the original description of *Aphareus* into French and reproduced two of the figures; besides he suggested that the genus ought to be referred to the Sergestidæ. In 1910 Borradaile established the genus *Sicyonella* on a new species, *S. maldivensis* Borr.; he described the animal and added two figures, but he did not perceive that the genus was identical with Paulson's *Aphareus*, and he referred it to the subfamily Sicyoninæ, of the family Penæidæ, which was rather unfortunate, and the worst result of his classification is the misleading generic name. In 1913 W. T. Calman proposed the name *Aphareocaris* for *Aphareus* Pauls. which was preoccupied, but overlooked that the genus was identical with *Sicyonella* Borrad., and according to the rules of priority the latter name must be applied. Calman referred his form *A. elegans* Calm. to the family Sergestidæ, pointed out several important characters as to which the genus agrees with *Sergestes*, and besides three generic differences between it and *Sergestes*; among these the character based on the male antennulæ cannot be maintained, as later seen by Calman himself. He described a single species, *A. elegans*, from the Torres Straits, and added 16 figures; his investigation and his figures are so good that I have found it unnecessary to redescribe the type, its appendages and branchiæ or to draw new figures of the entire animal or most of its appendages. — In 1914 Calman published an additional note, as Dr. H. Balss had drawn his attention to the similarity between *Aphareocaris* Calm. and *Sicyonella* Borrad. He discussed the differences between Borradaile's statements and his own in 1913, suggested that his *A. elegans* Calm. most probably had been established on an immature specimen, and that it must be considered as a synonym to *Sic. maldivensis* Borrad., but whether this conclusion may be safe is to be discussed later on. Finally Calman published a new figure of the petasma of the adult *Sic. maldivensis*, which renders it possible to recognize this species with absolute certainty.

Sicyonella Borrad. differs from *Sergestes* in the following characters. 1) The first pair of legs have a well developed chela which is wanting in *Sergestes*; 2) second an third pairs of legs have the chela much more developed with the fingers much longer in proportion to the hand than in *Sergestes*; 3) the two last pairs of legs have seven joints, while in *Sergestes* the seventh joint is absent; 4) telson has some pairs of dorsal spines, but no spines in *Sergestes*; 5) the processus ventralis of the male petasma is cleft into two very long branches, while it is undivided in *Sergestes*. In all these characters, excepting perhaps the last mentioned, *Sicyonella* stands nearer to the Penæidæ than *Sergestes*. The main differences between the Penæidæ and *Sergestes-Sicyonella* together with figures illustrating most of the generic features of *Sicyonella* are to be looked for in Dr. Calman's paper.

Three species have been established in the literature, among which *Sic. maldivensis* Borrad. can be determined with certainty by the aid of Calman's figure of the petasma in his

second paper, while it remains uncertain whether *S. elegans* Calm. is a valid species or a synonym, as according to CALMAN's figures in his first paper its petasma seems to differ more from that in the adult *Sic. maldivensis* than might be expected between petasma in the immature and that in the adult male of the same species. It cannot be settled with any certainty whether *Sic. inermis* Paulson is identical with *Sic. maldivensis* Borrad. or a separate species before new specimens have been gathered in the Red Sea.

In the "Siboga" material 2 species are found, viz. *Sic. maldivensis* Borrad. and a fine new species; of the latter I have fortunately also a good material from the Gulf of Siam.

1. *Sicyonella maldivensis* Borrad. Pl. II, figs. 4*a*—4*g*.

1910. *Sicyonella maldivensis* Borradaile, Trans. Linn. Soc. London. 2nd Ser. Zool., Vol. XIII, pt 2, p. 259, Pl. 16, fig. 3, 3*a*.
1913. (?) *Aphareocaris elegans* Calman, Journ. Linn. Soc. London, Zool. Vol. XXXII, p. 219, Pl. 16, figs. 1—16.
1914. *Sicyonella maldivensis* Calman, Ann. Mag. Nat. Hist., ser. 8, Vol. XIII, p. 259, figs. A, B.

Stat. 164. August 20. Lat. 1°42′.5 S., long. 130°47′.5 E. 32 m. Sand, small stones. Dredge. 2 females.
Stat. 213. Sept. 26—Oct. 26. Saleyer-anchorage and Surroundings. Depth up to 36 m. Coral-reefs, mud and mud with sand. 2 males, 1 female.
Stat. 323. Febr. 24—25. Sangkapura-roads, Bawean-island. 12 m. Mud. 11 small specimens.

Description. — Dorsal crest of the carapace with two acute teeth, not including the short, acute rostral process. Eyes distinctly larger in the male (fig. 4*a*) than in the female (fig. 4*b*); in the female the distance from the base of the long second joint of the eye-stalk to the end of the cornea is somewhat more than two and a half times as long as the breadth of the cornea, while in the male the same distance is only somewhat more than twice as long as the breadth of the cornea. The antennular peduncles in the female moderately long; the inner margin of its two distal joints combined nearly as long as the same margin of first joint; second joint rather broad, not quite twice as long as broad, and its inner margin nearly one-fourth as long again as third joint, which is somewhat slender. In the male the two distal joints combined are considerably longer than in the female, with their inner margin very conspicuously longer than that of first joint; second joint is a little longer and proportionately a little narrower than in the female, and its inner margin is slightly shorter than third joint, which is distinctly thicker and considerably longer than in the female. The lower flagellum in the male (fig. 4*c*) has the proximal portion widened with the lower margin somewhat convex, while the upper margin is very concave excepting towards both ends of the widened portion, so that in reality only the short proximal and the longer distal parts of the portion with the lower margin convex are thick; the upper margin of the curved portion is equipped with a little more than twenty spines which are long on the thick parts, shorter and considerably less closely set on the middle part of the concavity. — The antennal squama reaches in the female about to the middle of third antennular joint, in the male rather little beyond second joint.

First pair of legs moderately slender; fifth joint (fig. 4*d*) is somewhat shorter than the chela and has on the lower side a peculiarly shaped group of pectinate spines answering to a

group in *Sergestes*; the chela is not fully six times as long as broad, with a longitudinal row of thin spines on the subproximal part of the lower side near the margin; the hand is a little more than half as long again as the movable finger. Third pair of legs much longer and much more slender than first pair; the chela in an adult female is about fourteen times as long as broad, and the hand is scarcely three times as long as the movable finger.

The petasma (figs. 4*e*—4*g*) is very characteristic. Pars externa is not small but peculiarly reduced; its lamina (*lam.*) is more than twice as long as broad, with a very obtuse angle of the outer margin somewhat before its middle; processus uncifer (*pu.*) is less than half as long as the lamina but broad, only twice as long as broad, tapering towards the broadly rounded end, which has no hook. Processus ventralis (*pv.*) is very long, divided to rather near the base into two branches, the longest situated behind the other, and covering its major part when the petasma is seen from behind (figs. 4*e* and 4*f*); the posterior branch has its distal half divided again into two branches, the outer somewhat slender, straight and terminating in a hook, the inner somewhat longer, rather curved and considerably broader than the other, and its distal part is expanded outwards forming a plate which has one extremely large hook and a small hook at the outer margin; the anterior branch of processus ventralis is moderately slender, but nearly its distal fourth is expanded essentially and very strongly outwards, constituting a transverse plate which has a row of small hooks at the inner margin and a few similar hooks at the terminal margin. Lobus armatus (*la.*) projects far beyond the insertion of the processus ventralis and about from the middle of the capitulum; it is directed wholly outwards, thus nearly vertical on the main direction of pars media; it is broad, rather long and tapers considerably beyond its middle to the obtuse end; an extremely large hook is seen on its distal margin somewhat from the end, and five smaller hooks near the oblique terminal margin. Along the inner margin of the sub-proximal half of the capitulum is found a somewhat feeble expansion with about six hooks near the margin (fig. 4*g*), and it terminates in a rudiment of a lobe; the whole expansion may perhaps be considered as a kind of lobus accessorius. Lobus terminalis (*lt.*) is directed forwards, straight, somewhat short and slender, with several minute hooks near the inner margin and at the end; at its base projects outwards and a little forwards a triangle with the end obtuse and equipped with two hooks, and this triangle I consider as the lobus connectens (*lc.*). Lobus inermis does not exist. Pars astringens (fig. 4*e*, *a.*) is broad, moderately long, with a long row of coupling hooks.

Length of a male 23 mm., of a female 24 mm.

Remarks. — CALMAN's figures of the petasma taken from one of BORRADAILE's types of *Sic. maldivensis* show that the "Siboga" specimens belong to the species described by BORRADAILE. But it seems to me somewhat doubtful that *Sic. (Aphareocaris) elegans* Calm. is the young male of *Sic. maldivensis*, because the petasma, according to CALMAN's figures, must be so different from that in *Sic. maldivensis* that I cannot think it to be a not fully developed organ of the latter species. The differences between *Sic. maldivensis* and the following species are pointed out later on.

Distribution. — BORRADAILE writes: "Specimens were taken throughout the Maldives and in Cargados Carajos in various depths".

2. *Sicyonella antennata* n. sp. Pl. II, figs. 5*a*—5*c*; Pl. III, figs. 1*a*—1*f*.

Stat. 258. Dec. 12—16. Tual-anchorage, Kei-islands. 22 m. Lithothamnion, sand and coral. 1 male, 1 female.

The Copenhagen Museum possesses 14 specimens taken by Dr. TH. MORTENSEN in 1900 in the Gulf of Siam at various localities, viz. between Koh Mesan and Cape Liant, 9 fathoms; Koh Kahdat, 4—5 and 5 fathoms, and South of Koh Mak, 5—6 fathoms.

Description. — Rostrum with dorsal crest nearly as in *Sic. maldivensis*. Eyes distinctly larger in the male (fig. 1*a*) than in the female (fig. 1*b*) and larger than in the preceding species; in the female the distance from the base of the long second joint of the stalk to the end of the cornea is distinctly more than twice as long as the breadth of the cornea, while in the male the same distance is scarcely twice as long as that breadth. The antennular peduncles in the female a little longer and distally more slender than in the female of *Sic. maldivensis*; the inner margin of the two distal joints combined is distinctly longer than that margin of first joint; second joint a little longer than in *Sic. maldivensis*, with the inner margin slightly longer than, or as long as, third joint. In the male the two distal peduncular joints are elongated, the inner margin of both joints combined only somewhat less than twice as long as the inner margin of first joint; third joint proportionately slender and considerably longer than the second. The lower flagellum in the male (fig. 5*a*) in the main as in *Sic. maldivensis*, yet differing in having a much lower number of spines on the concave margin.

First pair of legs (fig. 5*b*) a little more slender than in *Sic. maldivensis*; the chela is shorter than fifth joint, a little more than six times as long as broad, and the hand is somewhat more than half as long again as the movable finger. Third pair of legs still more slender than in *Sic. maldivensis*; the chela of a female (fig. 5*c*) is about sixteen times as long as the breadth of the hand at its middle, and the hand is somewhat more than three times as long as the movable finger.

The petasma (figs. 1*d*—1*f*) differs strongly from that in *Sic. maldivensis*. The pars externa is about as large as in *Sic. maldivensis*, but somewhat differently shaped; the lamina externa (*lam.*) is twice as long as broad, with the obtuse angle on the outer margin somewhat before the middle; processus uncifer (*pu.*) is considerably more than half as long as the lamina, narrow from the base to the rounded end which has no incision. A processus basalis is not developed. Processus ventralis (*pv.*) is very long, as in *Sic. maldivensis* divided into two branches, but the proximal undivided part is more than one-third as long as the whole process; the posterior branch is broad at the base, but tapers rapidly towards the middle, and distally it is divided into two secondary branches (fig. 1*e*), the inner nearly shorter than broad with a row of small hooks along the terminal margin, while the other secondary branch is generally longer, more narrow and directed much outwards, with some small hooks near the end; the anterior branch of processus ventralis is considerably shorter than the posterior, narrow excepting towards the base which is extremely expanded, and the terminal part of the branch is somewhat widened and rounded, with a good number of minute hooks on both sides. The capitulum, or distal main portion of pars media excepting proc. ventralis, is so different from that in *Sic. maldivensis* and from those in species of *Sergestes* known to me that I cannot interpret all the lobes

with certainty. Along the most proximal part of the inner margin a narrow area with a good number of hooks is seen (fig. 1*e*), probably a remnant of a lobus accessorius a little less developed than in *Sic. maldivensis*. This area is found on a moderately thick, very oblong body, which near the middle of the posterior side has two rather slender, subcylindrical lobes directed backwards and outwards, and each terminating in an extremely large hook; the outer of these processes is not improbably lobus armatus (*la.*), but the other must be an accessory lobe (*lac.*). More distally on the posterior side of capitulum is seen a somewhat long, very slender lobe directed mainly forwards and terminating in a rather large hook; this lobe (*lc.*) may answer to lobus connectens in *Sergestes*. The capitulum terminates in a long, gradually tapering lobe, lobus terminalis (*lt.*), which is nearly spirally twisted and has on one side a very large number of minute hooks; at the base of lobus terminalis a very short, truncate lobe projects forwards and inwards and terminates in a very large hook; this last-named protuberance is perhaps lobus inermis (? *li.*). — Pars astringens (fig. 1*d*, *a*) is very broad, with the usual marginal row of coupling hooks.

Length of a large male 25 mm., of a small male 18.5 mm.; a very large female measures 31.5 mm. in length, but adult females are sometimes considerably smaller, about 25 mm. long.

Remarks. — The male is instantly distinguished by the elongated antennular peduncles and the peculiar petasma; the female can be separated from that of *Sic. maldivensis* by the eyes, the two distal joints of the antennular peduncles, and the relative length of the antennal squama.

Distribution. — The localities hitherto known are enumerated above immediately after the "Siboga" station.

Acetes H. M.-Edw.

Diagnosis. — Body rather slender; general aspect nearly as in *Sicyonella*. Carapace anteriorly with a short crest, armed with a single denticle or most frequently with two denticles, and produced into a short rostral process. Supra-orbital and hepatic spines well developed. Antennulæ with second joint in the peduncle somewhat short; third joint in the female considerably, in the male from considerably to twice or almost three times longer than the second; the lower flagellum in the male with the clasping organ as in *Sergestes*. Antennæ as in *Sergestes*. Mandibles (Pl. III, fig. 2*e*) mainly as in *Sergestes*; palp 3-jointed, with first joint very short, second long and slender. Maxillulæ (Pl. III, fig. 2*f*) with both lobes well developed, but without palp. Maxillæ (Pl. III, fig. 2*g*) with only a single undivided lobe, while the palp (*p.*) is well developed, somewhat broad. First pair of maxillipeds (Pl. III, fig. 2*h*) differ considerably in shape from those in *Sergestes*; the distal lobe is long, very oblong-triangular with the end subacute; the palp is wanting, but exopod (*ex.*) and epipod (*ep.*) are well developed. Second pair of maxillipeds (Pl. III, fig. 2*i*) have the third joint long, much longer than the second and about as long as the fifth, which is very long, while the sixth is short and slender; exopod wanting; epipod and podobranchia well developed. Third pair of maxillipeds slender and long, but always somewhat or considerably shorter than third pair of legs; each leg with only six joints, as second joint is fused with the third; the two distal joints are undivided (Pl. III, fig. 2*k*);

above the maxilliped a single pseudobranchia is found. First pair of thoracic legs much shorter than third maxillipeds, terminating (Pl. III, fig. 2*l*) in a quite short, but not rudimentary chela, and its fingers have a kind of brush near the end; sixth joint near the base and the preceding joint near the end each with a close row of stiff, short setæ nearly as those found in *Sergestes*. Second pair of legs considerably longer than the first and much shorter than the third pair; second and third pairs slender and terminating in a very short chela agreeing with that of first pair; all three pairs with seven joints, but without epipod or exopod. Fourth and fifth pairs of legs wanting, but in the male a couple of very thick protuberances are found, marked off from the trunk by a suture or rather an articulation, directed mainly forwards and answering to the coxæ of a pair of legs, in all probability fifth pair (as already interpreted by KISHINOYE); these protuberances, which afford specific differences, are on the following pages described as the genital coxæ (*gc.* on Pl. III, fig. 2*n*). Above the thoracic legs four pleurobranchiæ are found, situated respectively above the three legs and above the place were the fourth leg, which is wanting, would be placed, but I have found no rudimentary lamellar branchia behind any of the four pseudobranchiæ.

The petasma is much reduced as compared with those in *Sergestes* and *Sicyonella*; pars externa has no processus uncifer, pars astringens is frequently wanting, and the distal portion of pars media has few ramifications, in most species only a processus ventralis and a capitulum without special lobes.

Remarks. — The genus *Acetes* differs from *Sergestes* in several characters: the maxillulæ and the first maxillipeds without palp, the maxillæ with undivided lobe, first pair of legs with a short chela as the two following pairs, fourth and fifth pairs of legs wanting excepting the coxæ of (probably) fifth pair in the male, finally only five pleurobranchiæ above third pair of maxillipeds and the thoracic legs. — In the absence of two pairs of thoracic legs *Acetes* agrees with *Lucifer*, but otherwise it is far removed from this peculiar genus and related to *Sergestes* and *Sicyonella*.

The species of *Acetes* are very similar in general aspect, and all are rather small animals. The eyes are nearly as large in the female as in the male. Specific characters found in both sexes are few, viz. the number of denticles — one or two — on the rostral crest, the size of the eyes, the relative length of the proximal thickened part of the upper flagellum of the antennulæ, the length of the ciliated portion of the outer margin of the exopod of the uropods as compared with the whole margin, finally to some degree the second joint in third pair of legs. The males show excellent specific characters in the relative length of third joint of the antennulæ, in the joints of the lower antennular flagellum and especially in the structure of its clasping organ, finally in the structure of the petasma. In the females the ventral area at and behind the base of last pair of legs affords most useful characters. The females are on the whole somewhat or even considerably larger than the males.

The genus *Acetes* was established by H. MILNE-EDWARDS in 1830 (Ann. Sci. Natur. T. XIX, p. 350; Pl. XI, figs. 1—9) on a species captured in the Ganges estuary and named *A. indicus*. His representation is fairly good, but the description of the form is of course now unsatisfactory. Fortunately his fig. 9, exhibiting the caudal fan, shows that the ciliated part of

the outer margin of the exopod of the uropods occupies scarcely one-third of the whole margin, and supposing this feature to be correctly drawn we have here an excellent specific character, which shows that *A. indicus* H. M.-Edw. differs from all the Asiatic forms seen by me and besides from any other species described in the literature, excepting *A. americanus* Ortmann from the Amazon estuary. The seas south and south-east of Asia evidently contain a good number of species of the genus *Acetes*; their distribution seems frequently to be somewhat restricted, and I think that *A. indicus*, taken in a place far distant from any other locality for any *Acetes* seen by me or described by other authors, has never been rediscovered, but ought to be looked for in the Ganges estuary.

It may be useful here to give a complete list of the species of *Acetes* hitherto established. In 1859 H. KRÖYER published an elaborate representation of a form which he referred to *Sergestes* and named *S. serrulatus* Kr.; he said he had found a couple of specimens among "different Crustacea from the most northern Kattegat". Already in 1896 I pointed out that *S. serrulatus* Kr. in reality is an *Acetes*; as the Copenhagen Museum possesses one of KRÖYER's two specimens I am now able to show that the Museum also possesses specimens from Java and to redescribe the form; that the locality "the most northern Kattegat" is extremely wrong does not require further comment. — In 1893 ORTMANN (Ergebnisse der Plankton-Expedition, Decap. und Schizop. Bd. II, G. b., p. 39, Taf. II, Fig. 2) established a species from the Atlantic, *A. americanus* Ortm., taken in the estuary of the Amazon river. — In 1905 KISHINOYE (Annotationes Zool. Japonensis Vol. IV, pt. 4, p. 163) described and figured a fourth species, *A. japonicus* Kishin., captured at various places in "the western parts of Japan" and in Korea; according to the somewhat imperfect figure of the petasma and for another reason *A. japonicus* is allied to but distinct from *A. dispar* n. sp., but whether it may be identical with *A. chinensis* n. sp., to be described later on cannot be settled, as the male of *A. chinensis* n. sp. is unknown, and KISHINOYE's description of the female genital area is imperfect and the area not figured. — In 1905 G. NOBILI published a preliminary description and in 1906 a more detailed account (Ann. Sci. Natur. Zool. 9. ser., t. IV, p. 23, Pl. I, figs. 5—5*e*) of a new species, *A. erythræus* Nobili, from the Red Sea; this species is larger than any seen by me, as the largest males measured 33 mm. in length, and the description together with the rather poor figure of the petasma is probably sufficient for recognizing the male.

In the literature the five species enumerated have been established by five authors, as no writer has seen specimens of more than a single form. Of these five species only one, viz. *A. serrulatus* Kr., is known to me, but I think that of the four others at least three are recognizable. The "Siboga" has secured two species, both new and tolerably represented, and besides a third form of somewhat doubtful quality. The Copenhagen Museum possesses two new species respectively from the Brazils and La Plata, furthermore from the "Siboga" area and the Gulf of Siam males and females of four species, viz. *A. serrulatus* Kr., one of "Siboga" forms, and two other species; finally females of at least two species from the seas near China. The result is that I can describe on the following pages no less than seven valid species represented in both sexes, the female of an eighth species, male and female of a species of doubtful quality, and the female of a variety or a new species.

The species of *Acetes* live near the coasts, sometimes in the estuary of large rivers or even in such rivers, generally in tropical and subtropical seas or countries, but yet going so far northwards as to Korea. The different species are similar in general aspect and therefore a careful investigation is necessary; probably there exist still a good number of undiscovered forms, and the geographical distribution of each species seems to be somewhat or much restricted. Judging from my material numerous specimens can frequently be taken in the same haul.

I. Species from Asia.

In all species from the seas south and east of Asia known to me the rostral crest has two denticles behind the acute tip. In the female the antennal squama reaches to, or distinctly beyond, the middle of third joint, but is far from reaching the end; in this sex the coxæ of third pair of legs have always a somewhat large, protruding tooth on the distal inner angle, while the inner margin of the coxæ is concave, and the proximal inner corner is produced into a flat, rounded protuberance.

It is easy to give a key to the males, but as to the females it is preferred to make it somewhat imperfect, because one of the best specific characters is the shape and structure of the genital area, which is next to impossible to deal with in a key.

Key to the Males.

A. Antennular peduncles with the third joint not much longer than in the female, only about half as long again as the inner margin of second joint, and shorter than the lower flagellum. The antennal squama reaches rather considerably beyond the end of second antennular joint. (Petasma has a well developed pars astringens with marginal coupling hooks).

a. Coxæ of third legs with a triangular tooth on the distal inner angle. In the petasma the capitulum is scarcely one-third as long again as processus ventralis . . . . . *A. vulgaris* n. sp.

b. Coxæ of third legs without any tooth on the distal inner angle. In the petasma the capitulum is elongated, about twice as long as processus ventralis. . . . . *Acetes* sp.

B. Antennular peduncles with the third joint very much longer than in the females, between twice and three times as long as the inner margin of second joint and at least almost twice as long as the lower flagellum. The antennal squama reaches scarcely or slightly beyond the end of second antennular joint.

a. Trochanter of third pair of legs without any tooth on the inner margin near its end.

α. Ciliated part of the outer margin of the exopod of the uropods conspicuously shorter than the glabrous part.

† Clasping organ of the lower antennular flagellum without any protuberance on the upper margin of the curved part of the "branch". Petasma has a well developed pars astringens with the row of marginal coupling hooks . . . . . *A. Sibogæ* n. sp.

†† Clasping organ of the lower antennular flagellum with a conspicuous protuberance directed backwards from the angularly bent upper margin of the "branch". Petasma without pars astringens . . . . . *A. serrulatus* Kr.

β. Ciliated part of the outer margin of the exopod of the uropods nearly or fully as long as the glabrous part . . *A. dispar* n. sp.

b. Trochanter of third pair of legs with a conspicuous triangular tooth on the inner margin near its distal end . . . . . *A. spiniger* n. sp.

Key to the Females.

A. Ciliated part of the outer margin of the exopod of the uropods conspicuously shorter than the glabrous part.

a. Trochanter of third pair of legs without any tooth on its inner margin near the end. . *A. vulgaris* n. sp., *A. Sibogæ* n. sp., and *A. serrulatus* Kr.

b. Trochanter of third pair of legs with a conspicuous triangular tooth on the inner margin just before the end . . . . . *A. spiniger* n. sp.

B. Ciliated part of the outer margin of the exopod of the uropods nearly or fully as long as the glabrous part. . . . *A. dispar* n. sp., and *A. chinensis* n. sp.

1. *Acetes vulgaris* n. sp. Pl. III, figs. 2*a*—2*r*.

Stat. 4. March 9. Lat. 7°42′ S., long. 114°12′.6 E. Anchorage off Djangkar (Java). 9 m. Coarse sand. 2 females.

Stat. 47. March 8—12. Bay of Bima, near south fort. 55 m. Mud with patches of fine coral sand. 1 female.

Stat. 311. Febr. 12—13. Sapeh bay, east coast of Sumbawa. Up to 36 m. Mud and sand. 1 female.

The Copenhagen Museum possesses specimens from the following four localities, of which two are within the "Siboga" area.

Surabaya, Java. Capt. ANDRÉA. 1870. 2 males.
Cheribon, Java. Capt. ANDRÉA. 1870. 8 males, 5 females.
Malakka. Cand. pharm. MARIUS JENSEN. Very large number of specimens.
Koh Kahdat, in the Gulf of Siam. Dr. TH. MORTENSEN 25/I 1900. Large number of specimens.

Male. — Eyes a little larger than in the other species, their transverse diameter being conspicuously more than half as long as the distal joint of the stalk with eye. Antennulæ (fig. 2*a*) with the two distal joints of the peduncle a little longer and thicker than in the female (fig. 2*b*), taken together not much longer than the outer margin of first joint; third joint scarcely or at

most half as long again as the inner margin of second joint. Thickened part of the upper flagellum about as long as the inner margin of second peduncular joint. Lower flagellum conspicuously longer than third peduncular joint, with 16—20 joints; its proximal part constitutes a shaft for the clasping organ and is distinctly 3-jointed (fig. 2*d*); the main "branch" of the organ has its proximal 4-jointed part conspicuously and evenly curved, and the joints decrease gradually in thickness; the fifth joint of this "branch" is nearly thicker than the fourth, with a close row of 4 or 5 strong spines directed downwards and often somewhat outwards, while each of the three preceding joints and the sixth joint has a single, much shorter spine, and the part beyond fifth joint contains 8—12 joints; obliquely below and outside the base of the main "branch" originates a single very strong and long, moderately curved spine, which reaches almost the above-named row of spines. The antennal squama reaches always rather considerably beyond the end of second antennular joint, but never to the middle of the third. Coxæ of third pair of legs (fig. 2*n*) with a very distinct, triangular, acute tooth on the distal inner angle, and the proximal inner corner is rectangular; the trochanter has no tooth near the distal end of its inner margin. Genital coxæ (fig. 2*n*, *gc.*) obliquely triangular, a little longer than broad, distally produced into a somewhat narrow, a little curved, subacute process. Exopod of uropods (fig. 2*m*) somewhat more than four and a half times as long as broad, and on the outer margin the ciliated part occupies about two-fifths of the whole length.

The petasma (figs. 2*p*—2*r*) is proportionately well developed. Pars externa (*e.*) is large, about twice as long as broad, with the distal inner angle subrectangular, and more than the distal third of the outer margin is somewhat convex. Pars astringens (*a.*) has a very long inner margin equipped with coupling hooks. Pars media has its proximal portion free and rather broad, with the basal margin somewhat concave so that two protuberances are formed, the inner short, the outer much longer, oblong-triangular, and directed much outwards. Considerably beyond the basal portion described is seen at the outer margin a piece connecting pars media with the pleopod. The capitulum (*c.*) and processus ventralis (*pv.*) are combined comparatively small, not much more than one-fourth of pars media; proc. ventralis is very robust, oblong-triangular, a little curved, acute, without armature; the capitulum itself is distinctly but not much longer than proc. ventralis, scarcely even one-third as long again as the process, thick, only a little more than twice as long as thick, much narrowed beyond the middle, but the distal part is moderately thick though at its middle less than half as thick as the proximal part, and broadly obtuse; seen from behind (fig. 2*q*) some quite small hooks are perceived near the end, but seen from in front (fig. 2*r*) two extremely large hooks are observed at the outer margin beyond the processus ventralis, more distally a distinctly or much smaller hook, and at the end some small hooks.

Length of a large male (from the Gulf of Siam) 24.5 mm., but sometimes the sex is considerably smaller, a small male from Sūrabaya being only 17.3 mm. long.

Female. — The sex differs from the male in the antennulæ, the coxæ of third legs and, of course, the genital area. The peduncles of the antennulæ (fig. 2*b*) are somewhat shorter, so that the antennal squama reaches distinctly beyond the middle of third joint; second and third joints less robust than in the male and combined nearly as long as the outer margin of

first joint; third joint about half as long again as second; thickened part of the upper flagellum longer than the inner margin of second joint; lower flagellum even a little longer than the two distal peduncular joints combined, in a good-sized specimen with about 24 joints. Coxæ of third pair of legs (fig. 2*o*) with the inner margin concave, as the proximal inner corner is produced mainly inwards as a small, rounded plate; trochanter without any tooth near the end of the distal inner margin.

The genital area is characteristic (fig. 2*o*); inside the small plate from the proximal angle of each coxa is seen a rounded protuberance, and somewhat behind these two protuberances a deep, transverse, distinctly procurved furrow runs across the surface of the body separating the two posterior thoracic segments, and the median part of the surface behind the furrow has a conspicuous impression.

Length a good-sized female from the Gulf of Siam 27 mm., while a very large specimen from Cheribon (Java) measures 33 mm.

Remarks. — As this species has been taken at more localities and in much larger numbers than any of the other forms, I give it the name *A. vulgaris*. It has affinities to "*Acetes sp.*" to be mentioned presently and to *A. Sibogæ* n. sp., but not to any other species.

Acetes sp. Pl. III, fig. 3*a*.

Stat. 47. March 8—12. Bay of Bima, near south fort. 55 m. Mud with patches of fine coral sand. 1 male, 2 females.

In a bottle with 16 specimens of both sexes of *A. Sibogæ* and 1 adult female of *A. vulgaris* I found 3 specimens, 2 among them adult, which are closely to *A. vulgaris* but show a few differences indicating a development between *A. vulgaris* and *A. Sibogæ*.

The Male, which is 23 mm. long, agrees with *A. vulgaris* as to the length of the joints in the antennular peduncles, and differs consequently from *A. Sibogæ* which has third peduncular joint much elongated; in the lower flagellum fifth joint of the jointed "branch" has only 2 long spines, while the sixth joint has one, and the seventh 2 long spines. Coxæ of third pair of legs agree with those in *A. Sibogæ* and differ from *A. vulgaris* in having no tooth on the distal inner angle. Genital coxæ nearly as in *A. Sibogæ*. In the petasma the processus ventralis (fig. 3*a*) has the outer margin more sinuate than in *A. vulgaris*, and the capitulum differs strongly from that in *A. vulgaris*, as it is nearly twice as long as processus ventralis and a little more than three times as long as broad, with the thick part distinctly longer than the more slender, tapering distal part; furthermore the distal part is much longer than in *A. vulgaris* and towards the end very slender; the armature on the front side of the capitulum differs considerably from what is found in the two species mentioned, the three hooks at the proximal part of the outer margins are present, but the proximal hook is enormous and the two other rather small, besides a good number of small hooks are arranged on the front surface mainly in a longitudinal row from near the big hook to near the end, and the most distal part has several irregularly arranged small or minute hooks.

An adult female, which is slightly larger than the male, agrees completely with

A. vulgaris in the shape of the genital area excepting that the couple of protuberances between the basal parts of the coxæ of third pair of legs are quite absent; in this feature it agrees with *A. Sibogæ*, but differs from this form in having no vestige of an elevated area between the coxæ and the transverse furrow.

Remarks. — It may be seen that the two specimens described exhibit characters found in *A. vulgaris* and others found in *A. Sibogæ*, while in the spines on the lower antennular flagellum, in the armature on the capitulum of the petasma and in the female genital area they differ from the two species named. Having only 1 male and 1 adult female I do not venture to establish a new species, though it is impossible to refer the specimens either to *A. vulgaris* or to *A. Sibogæ*; one is nearly tempted to suppose that the specimens may be bastards between the two species. Future students who possess a good material of this dubious form and allied species, may decide the question.

2. *Acetes Sibogæ* n. sp. Pl. III, figs. 4*a*—4*h*.

Stat. 147. March 8—12. Bay of Bima, near south fort. 55 m. Mud with patches of fine coral sand. 16 specimens of both sexes.
Stat. 323. Febr. 24—25. Sangkapura-roads, Bawean-island. 12 m. Mud. 10 adult males, 16 adult females, and 22 immature specimens.

Male. — Eyes (fig. 4*a*) smaller than in *A. vulgaris*, as the transverse diameter of the cornea is slightly more than half as long as the distal joint of the stalks with eye. Antennulæ with second joint conspicuously longer and thicker than in the female, third joint slender and very elongated, not fully two and a half times as long as the inner margin of second joint. Thickened part of upper flagellum a little shorter than the inner margin of second joint. Lower flagellum at most a little longer than the inner margin of second peduncular joint, with 13 joints (fig. 4*b*); the shaft of the clasping organ is 3-jointed, the jointed main "branch" with only 10 joints, consequently considerably shorter than in *A. vulgaris*, while its proximal half is rather curved and armed below with spines nearly as in that species; a single long, robust, moderately curved spine originates beneath the base of fourth joint of flagellum and reaches nearly to the spines on fifth joint of the main "branch". Antennal squama reaches to the end of second antennular joint. Coxæ of third pair of legs (fig. 4*d*) without any vestige of a tooth at the distal inner angle. Genital coxæ (fig. 4*d*) as long as broad, with the terminal corner produced as a very short, subacute process. Exopod of uropods (fig. 4*c*) nearly four and a half times as long as broad; on the outer margin the ciliated part occupies slightly more than two-fifths of the whole length.

The petasma (figs. 4*f*—4*h*) is related to that in *A. vulgaris*, but shows some differences. The inner margin with hooks of pars astringens is considerably shorter than in *A. vulgaris*, while the differences observed in the pars externa and the proximal half of pars media are slight. The processus ventralis (*pv.*) is not as long as in *A. vulgaris*, and its outer margin is much more sinuate. The capitulum (*c.*) is rather different; it is twice as long as processus ventralis and more than three times as long as thick; a little more than its distal third is a slender process tapering to the narrow, obtuse end; near the outer margin towards the processus

ventralis two gigantic hooks are seen on the front side (fig. 4*h*), and at the end of the narrow part two or three minute hooks are seen on both sides.

Length 15.7 mm.

Female. — Similar to the male excepting in the antennulæ, the coxæ of third pair of legs, and the genital area. The peduncles of the antennulæ as in the female *A. vulgaris*, so that a reference to the description is sufficient; lower flagellum consists of about 14 joints, and it is almost as long as the two distal peduncular joints combined. Coxæ of third pair of legs with the inner side nearly as in the female *A. vulgaris*, having at the distal end a strong tooth (fig. 4*e*), the inner margin concave and the produced rounded small plate at the base; trochanter with the produced inner end sometimes close to next joint, sometimes turned a little outwards and then seen as a free acute angle or minute tooth, but no tooth is, as in *A. spiniger*, found on the inner side just before the end.

The genital area (fig. 4*e*) differs from that in *A. vulgaris*; there is no trace of protuberances between the coxæ of third legs; the deep transverse furrow is sinuate, having its sublateral parts procurved and the median part recurved. Between the coxæ and the furrow the median third of the lower surface has an elevated area which has its raised lateral margins somewhat convergent, while the posterior margin is bent a little backwards at the middle, and each half is a little concave or frequently straight (fig. 4*e* shows the area in its most developed form).

Length 21.7 mm.

Remarks. — *A. Sibogæ* is more allied to *A. vulgaris* than to any of the following species; its male differ from *A. vulgaris* especially in the long third joint of the antennulæ, in having no distal tooth on the coxæ of third legs, and in the capitulum of the petasma, while the males of the following forms differ from those of *A. vulgaris* and *A. Sibogæ* in having the genital coxæ broadly rounded anteriorly and no pars astringens on the petasma.

3. *Acetes dispar* n. sp. Pl. III, figs. 5*a*—5*f* and Pl. IV, fig. 1*a*.

Not gathered by the "Siboga", but the Copenhagen Museum possesses specimens from two localities, one of which is within the "Siboga" area.

Cheribon, Java. Capt. ANDRÉA 1870. 1 male, 4 females.
Lem Ngob, Gulf of Siam, in a mangrove-swamp. Dr. TH. MORTENSEN 23/XII 1899. 2 males and 1 immature specimen.

Male. — Transverse diameter of the eye (fig. 5*a*) only about half as long as the distal joint of the stalk with eye. In the antennular peduncles second joint is half as long as the first; third joint is slender and very elongated, more than two and a half times as long as the inner margin of second joint; thickened part of the upper flagellum somewhat shorter than the inner margin of second peduncular joint. Lower flagellum a little longer than the inner margin of second peduncular joint, with 13 joints; the shaft of the clasping organ (fig. 5*b*) is proportionately longer than in *A. vulgaris*, 3-jointed with first joint long; the main "branch" has 10 joints, the proximal part is considerably curved with 2 or 3 small spines on fifth joint,

1 longer spine on each of the two preceding joints and 1 spine on the side of second joint; third joint of the shaft is produced in a protuberance below the insertion of the main "branch" and on that protuberance two spines are inserted, both strongly curved, the lower robust, extremely long, reaching the spines on fifth joint of the main "branch", the upper spine scarcely half as long as, and much more slender than, the other. Antennal squama reaches to the end of second joint of the antennulæ. The coxæ of third legs (fig. 5*d*) with a tooth at the distal inner angle, while the trochanter has no tooth near its inner end. Genital coxæ (fig. 5*d*) considerably broader than long, anteriorly very broadly rounded. Exopod of uropods (fig. 5*c*) nearly four and a half times as long as broad; the ciliated part of the outer margin is almost as long as the glabrous part.

The petasma is most characteristic (figs. 5*e*—5*f*). Pars astringens is completely wanting; pars externa (*e.*) is somewhat large, about three times as long as broad, with the inner margin rather concave, so that the plate is broader towards the base and considerably beyond the middle than at the middle. Pars media has its proximal part somewhat broader than in the two preceding species, and its basal margin is somewhat feebly concave, while the outer corner is more produced than the inner. Processus ventralis (*pv.*) which originates before the middle of pars media, has the proximal half thick, ovate, while its distal half is a slender, acute needle. When considering the portion beyond the insertion of processus ventralis as the capitulum (*c.*), its proximal major part is moderately thick, while the most distal part is broader, somewhat widened especially inwards and forwards, oblique-ovate, with numerous hooks on the outer part both on the posterior and the anterior surface.

Length 12.5 mm.

Female. — Eyes and antennulæ nearly as in the female *A. Sibogæ*; lower flagellum scarcely as long as third and half of second peduncular joint combined; antennal squama does not quite reach the middle of third antennular joint. Coxæ of third pair of legs (fig. 1*a*) in the main as in the females of *A. vulgaris* and *A. Sibogæ*; trochanter without any tooth near the distal inner end. Exopod of uropods as in the male, consequently differing from the females of the two species mentioned in having the ciliated part of the outer margin almost or fully as long as the glabrous part.

The genital area (fig. 1*a*) is characterized by a large, subquadrangular plate somewhat broader than long; the plate begins between the posterior part of the coxæ of third legs and reaches considerably behind the transverse furrow separating the last thoracic segment from the penultimate; when the animal is inspected from the side, it is easily observed that this plate protrudes freely below the ventral surface of the segments, and that a longitudinal section through the plate would be very oblong-triangular; seen from below the plate has its posterior angles broadly rounded and the posterior margin otherwise rather deeply concave; each lateral part of the plate is elevated as a kind of keel, and the median line and the posterior margin are a little elevated, so that the plate has two hollowed areas.

Length of the largest specimen 15 mm.

Varietas vel sp. n.? — The Copenhagen Museum possesses 5 females taken pelagically at lat. 24° 17′ N., long. 118° 15′ E. by Capt. Suenson. They agree with *A. dispar* in all features

excepting the genital plate. In these females the plate (fig. 2*a*) is less broad and considerably shorter than in the typical *A. dispar*, and it reaches only to or a little beyond the transverse furrow; its posterior margin is somewhat concave or nearly straight, and the keels on its lower surface are feeble. Length of a large specimen 22 mm. — Having no males I am unable to settle whether these females are only a variety of *A. dispar* or belong to a separate species.

Remarks. — *A. dispar* is instantly separated from all forms known to me, excepting *A. chinensis* n. sp., in having the ciliated part of the outer margin of the exopod of the uropods almost or fully as long as the glabrous part. Judging from the petasma it is allied to *A. japonicus* Kishinoye, but as the Japanese author, who had a rich material of his form, does not mention any sexual difference in the length of third joint of the antennular peduncles, it is impossible to refer the typical *A. dispar* to his form, because the third joint mentioned is so very much elongated in the male *A. dispar*, that it seems to be impossible that KISHINOYE could overlook such a sexual difference. Perhaps the females described as a possible variety belong to the Japanese form.

4. *Acetes chinensis* n. sp. Pl. IV, figs. 3*a*—3*b*.

Not taken by the "Siboga", but the Copenhagen Museum possesses females from the following localities.

Lat. 33° 10′ N., long. 129° 18′ E. 40 fathoms. Capt. SUENSON, 17 Sept. 1897. 5 females.
Formosa Channel, 25 fathoms. Capt. SUENSON, 23 May 1897. 1 female.

Female. — It agrees with *A. dispar* in the antennulæ, the coxæ and trochanteres of third pair of legs and the exopod of the uropods (fig. 3*b*), but differs sharply in the shape of the genital plate. Inside the small rounded plate projecting from the proximal inner corner of each coxa of third legs a minute protuberance is found. Seen from the side the posterior part of the genital plate is much thicker than in *A. dispar*; seen from below (fig. 3*a*) the plate overreaches somewhat the furrow between the two last thoracic segments; from its broad base its lateral margins converge strongly backwards and curve finally so much inwards, that the posterior margin is their direct continuation; the latter margin is incised at the middle; the lower side of the plate has a broad, longitudinal excavation which especially in its posterior half is deep, so that each lateral part of the plate looks as a thick, oblong protuberance.

Length 22—32 mm.

Remarks. — The genital plate differs so much from that in *A. dispar* that the animals must belong to a separate species, possibly *A. japonicus* Kishinoye, and it can not be difficult to recognize the species with certainty.

5. *Acetes serrulatus* Kröyer. Pl. IV, figs. 4*a*—4*h*.

1859. *Sergestes serrulatus* Kröyer, Kgl. D. Vid. Selsk. Skrifter, Math.-naturv. Afdeling IV, 2, p. 268, Tab. IV, fig. 12, *a*—*g*.

The "Siboga" has not secured this species, but the Copenhagen Museum possesses it from 3 places, 2 of which within the "Siboga" area.

Surabaya, Java. Capt. ANDRÉA 1870. 5 males, 9 females.
Cheribon, Java. Capt. ANDRÉA 1870. 1 male.
"Indo-Chinese Sea", SCHMIDT. 1 female.

Male. — Eyes (fig. 4*a*) smaller than in *A. vulgaris*, their diameter being generally a little less than half as long as the distal joint of the stalk with eye. Peduncles of the antennulæ nearly as in *A. dispar*; third joint from a little less to more than two and a half times as long as the inner margin of second joint. Thickened part of upper flagellum conspicuously shorter than the inner margin of second joint. Lower flagellum (fig. 4*c*) differs considerably from those in all other species; it contains only 12 joints, as fourth and fifth joints are fused; its shaft looks as if it consisted of only two moderately long joints, while the oblong and much more slender third joint has the insertion of fourth joint on its upper side at the base, as the third joint is produced considerably in advance of that insertion; fourth joint, the first of the main "branch", is almost vertical on the third, slender at the middle and with a triangular, very conspicuous protuberance projecting backwards from its upper posterior angle. Second and third joints of the main "branch" each with a long and strong spine below at the end, and a short, robust spine on the outer side; fourth joint with 3 moderately long spines below, while the 5 remaining joints are more slender and without spines. From the protruding end of third joint of the shaft two extremely long spines project, both nearly straight to somewhat from the end, and the apical part is curved strongly upwards; the lower spine is somewhat longer and thicker than the upper and reaches to the distal group of spines on the main "branch". — The antennal squama reaches to or slightly beyond the end of second antennular joint. The coxæ of third pair of legs with a tooth from the distal inner angle (fig. 4*e*); the trochanter without tooth near the end. Genital coxæ (fig. 4*e*) much broader than long, anteriorly broadly rounded. Exopod of uropods (fig. 4*d*) a little less than five times as long as broad; on the outer margin the ciliated part is obviously shorter than the glabrous portion, as it occupies from scarcely less to a little more than two-fifths of the whole length.

The petasma (fig. 4*g*) is very curious. Pars astringens is wanting. Pars externa (*e.*) is four times as long as broad, with the inner margin straight to near the end, the outer margin subparallel with the inner to considerably beyond the middle, and then evenly curved to the distal inner angle. Pars media is proportionately very slender excepting towards both ends; its proximal part is at the free end produced into an inner and an outer process, both very oblong, curved respectively strongly inwards and outwards, with their ends obtuse; processus ventralis wanting; the distal half of pars media, the capitulum, has its proximal portion slender, and then it is expanded on the outer side, so that this flattened portion is somewhat more than half as long again as broad, with about 7 hooks along the convex outer margin (fig. 4*h*), while the broad end is cut off transversely and armed with a big, triangular spine.

Length 11.5—16.5 mm.

Female. — Very similar to the female of *A. dispar* as to the eyes, the antennulæ, and the coxæ of third legs. The antennal squama reaches the middle of third joint of the antennulæ. Trochanter of third legs without any tooth near the end. Exopod of uropods as in the male, consequently differing from that in the female *A. dispar*. The genital area (fig. 4*f*)

is uncommonly simple; the furrow between the last and the penultimate thoracic segment is quite free, deep, and curved a little forwards; there are no protuberances between the coxæ and no plate, but the transverse somewhat narrow area, marked off posteriorly by the furrow and anteriorly by the limit between fourth and third segment running between the posterior part of third coxæ, is very convex in the longitudinal direction.

Length of a large specimen 20.5 mm.; the type for fig. 4*f* is 15.5 mm. long.

Remarks. — The male *A. serrulatus* is easily distinguished from all other forms by the triangular protuberance from the upper end of first joint in the main "branch" of the lower antennular flagellum; the reduced and curiously shaped petasma affords another fine character. The female is distinguished by the genital area. — It may be noted that in the female from the Indo-Chinese Sea the front crest on the carapace has only a single dorsal denticle, the posterior, as the anterior denticle, which is small in normal specimens, has vanished.

6. *Acetes spiniger* n. sp. Pl. IV, figs. 5*a*—5*h*.

Not captured by the "Siboga", but the Copenhagen Museum possesses specimens from 3 localities, one among them within the "Siboga" area.

Surabaya, Java. Capt. ANDRÉA 1870. 6 females.
10 miles off Rangoon. HANSEN & THALBITZER. About 35 specimens.
"Indo-Chinese Sea". SCHMIDT. 1 male, 2 females.

Male. — Transverse diameter of the eyes a little less than half as long as the distal joint of the stalk with eye. Antennulæ (fig. 5*a*) with second joint a little elongated and somewhat thickened; third joint very elongated, from a little more than twice to a little less than three times as long as the inner margin of second joint, and when this joint is extremely long it is proportionately more slender than when it is only a little more than twice as long as the margin mentioned. Thickened part of the upper flagellum considerably shorter than the inner margin of second peduncular joint. Lower flagellum (fig. 5*c*) considerably longer than second peduncular joint, with 12 distinct joints; the shaft is long, one-third of the whole flagellum, 3-jointed, and third joint with the end a little produced, free; first joint of the main "branch" long, in reality consisting of two joints completely or — in a single male — somewhat incompletely fused; the four proximal joints of the main "branch" taken together feebly curved, compressed and somewhat high, highest at the middle; second and third joints each with a moderately long spine below, and fourth joint with a row of 6 or 7 spines, the distal ones short (in the large male from the Indo-Chinese Sea first joint has a spine below, the spines on the three other joints are longer, and fourth joint has 8 spines). Third joint of the shaft has above at the middle a somewhat small, spiniform, curved process looking mainly forwards, and its end has the usual extremely long, thick spine, the submedian part of which is much curved, and the spine reaches to the spines on fourth joint of the main "branch"; before the insertion of the very long spine a short, straight spine originates near the end of the upper margin of the joint. Antennal squama reaches to or slightly beyond the end of second antennular joint. Coxæ of third pair of legs (fig. 5*e*) with a good-sized tooth at the distal inner angle; the

trochanter has a very conspicuous, triangular tooth on the inner side just before the end. Genital coxæ (fig. 5*e*) much broader than long, anteriorly rather broadly rounded. Exopod of uropods (fig. 5*d*) slender, five times as long as broad; on the outer margin the ciliated part occupies more than two fifths, but conspicuously less than half of the length.

The petasma (figs. 5*g*—5*h*) has no pars astringens. Pars externa (*e.*) is about three times as long as broad, and from a little beyond the middle the feebly convex outer margin converges with the inner margin to the narrow but obtuse end. Pars media is moderately slender; its proximal free part is long, with the outer margin concave to near the base, as this most proximal part is expanded on the outer side and the basal margin is oblique, not concave. Processus ventralis (*pv.*), which originates at the middle of pars media, is a very long, acute needle reaching to somewhat from the end of the capitulum (*c.*) and with the base itself widened; the capitulum is more than three times as long as broad, narrower at the base than before the middle, with the outer margin somewhat convex to the broad, rounded end; numerous hooks are arranged both on the anterior and the posterior side along the outer margin and on the terminal portion.

Length 18 mm., a single large specimen 22 mm.

Female. — Eyes and antennulæ in the main as in the females of the preceding forms; thickened part of the upper flagellum of the antennulæ at least as long as second peduncular joint; lower flagellum as long as second and third joints combined, with about 20 joints. Antennal squama reaches about to the middle of third antennular joint. Coxæ of third pair of legs (fig. 5*f*) as in the female *A. vulgaris*, with the distal inner tooth very developed; trochanter as in the male with a very conspicuous, acute tooth on the inner side just before the end. Exopod of uropods as in the male.

The genital area (fig. 5*f*) differs much from that in any preceding species. Inside the posterior rounded process from each coxa is seen a rounded protuberance; the furrow between the penultimate and the last thoracic segments has its middle portion extremely developed, the part of the penultimate segment situated behind each coxal protuberance is elevated as a high and rather large, rounded protuberance directed somewhat backwards and therefore overlapping a small part of the furrow; between these two pairs of protuberances the segment is deeply excavated, and this excavation continues on the most anterior part of the last segment which has a pair of oblong, essentially transverse protuberances narrowing the excavation from each side.

Length generally 25—29 mm.; an extremely large specimen measures 33.5 mm.

Remarks. — *A. spiniger* is easily separated from the five preceding species by the tooth on the inner margin of the trochanter of third legs. In the male the clasping organ of the antennulæ and the petasma, in the female the genital area afford other excellent specific characters. — It may be noted that in the large male from the "Indo-Chinese Sea" the third joint of the antennulæ is less elongated (only a little more than twice as long as the inner margin of second joint) than in the males from off Rangoon, and its clasping organ on the antennulæ is also a little more spinose, but these differences are only variation of slight importance.

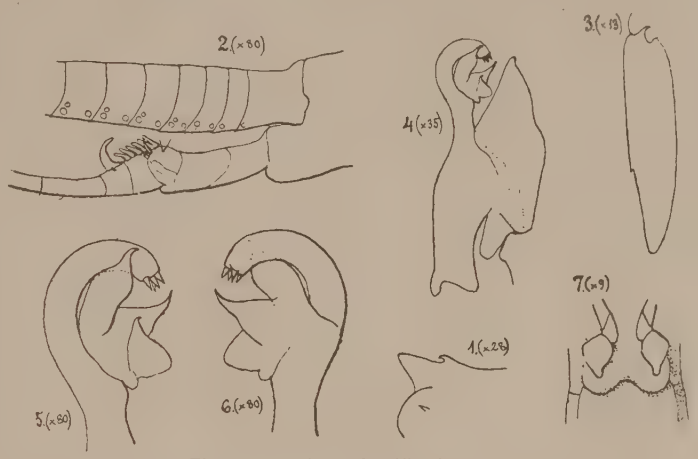
II. Species from the Atlantic side of America.

7. *Acetes brasiliensis* n. sp. Figs. 1—7 in the text.

The Copenhagen Museum possesses this species from a single place.

Brazil. COLLIN. 1 male, 1 female.

Male. — The anterior keel on the carapace has only a single tooth (fig. 1), as the denticle, which in most forms exists between the tooth mentioned and the rostrum, has disappeared. The rostrum is short with the end obtuse. Eyes about as in *A. spiniger*. Antennulæ with the peduncle long; third joint very elongated, a little less than two and a half times as long as the inner margin of second joint. (The thickened part of the upper flagellum mutilated). Lower flagellum (fig. 2) has lost its distal joints in my specimen; its shaft is 3-jointed; the two proximal joints of the main "branch" are apparently fused and have a close row of 6 thick, obtuse spines, and outside this row 2 spines; the following joint has a strongly curved and very robust spine twice as long as any of the other spines, but the third joint of the shaft has no produced free part, and no trace could be found of the very long spine projecting in all other species from that free part. The antennal squama reaches the end of second joint of the antennulæ. Coxæ and trochanteres of third pair of legs without any tooth at their distal inner angle. Genital coxæ considerably broader than long, anteriorly very broadly rounded. Exopod of uropods (fig. 3) nearly four and a half times as long as broad; the ciliated part occupies scarcely two-fifths of the outer margin, and a minute tooth is seen at the end of the glabrous part.



Figs. 1—7. *Acetes brasiliensis* n. sp.
Fig. 1. Front end of the carapace of the male.
Fig. 2. Proximal parts of upper and lower flagellum of left male antennula.
Fig. 3. Exopod of left male uropod.
Fig. 4. Left petasma, from behind.
Fig. 5. Capitulum of the same petasma, from behind.
Fig. 6. Same capitulum, from in front.
Fig. 7. Genital area and proximal parts of third legs of a female.

The petasma (figs. 4—6) is peculiar. Pars astringens is completely wanting. Pars externa well developed, about two and a half times as long as broad; its distal two-fifths triangular and slightly longer than broad. Pars media is moderately slender; its free proximal part is long with the lateral margins subparallel, and the basal margin somewhat deeply and obliquely concave, while the inner proximal corner is produced into a somewhat short, obtuse process, the outer corner much broader, rounded. Beyond the insertion of pars externa pars media narrows greatly to the thickened capitulum, and a processus ventralis could not be made out; the capitulum is subglobular, but consists of four lobes, the inner long, sausage-shaped (fig. 5),

much curved and terminating in four thick and short spines; the three other lobes are much shorter, and each produced into an acute point.

Length 15.5 mm.

Female. — Rostrum and crest as in the male. (The antennulæ mutilated, only the first joint present). Coxæ of third pair of legs (fig. 7) with the major part of the inner margin convex and no tooth below or at the end, while the proximal inner corner is produced into a protuberance about as in the species from Asia. The genital area (fig. 7) is moderately short but broad; the median part of its posterior margin, the transverse furrow, is strongly procurved, while each sublateral part is produced backwards and very broadly rounded; the genital area thus limited posteriorly is, seen from below, distinctly elevated, and its median part is longitudinally a little concave, but no tubercles are observed.

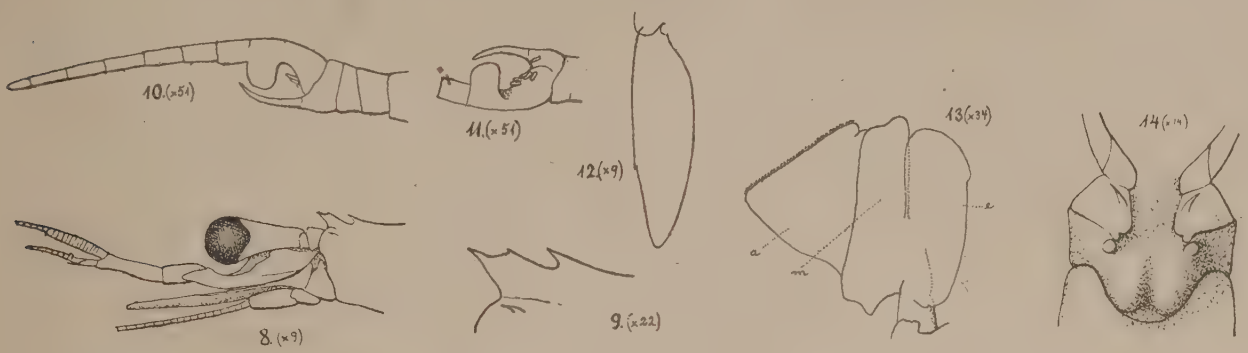
Remarks. — *A. brasiliensis* seems to be allied to *A. americanus* Ortmann, from the estuary of the Amazon River. Both species agree in having only a single median tooth behind the rostrum. Unfortunately Ortmann's figure of the copulatory organ is poor and small, and of the clasping organ on the male antennulæ he has no figure or description, so that these organs, which always afford good characters, cannot be compared with the features in *A. brasiliensis*. But two features remain which render it impossible to refer *A. brasiliensis* to the species established by Ortmann. He has examined specimens of both sexes and has not a word on any sexual difference in the length of third joint of the antennulæ, but in *A. brasiliensis* that third joint is so strongly elongated in the male that he could not have overlooked this feature. In Ortmann's fig. 27 the exopod of the uropod has the glabrous part of the outer margin somewhat more than twice as long as the ciliated part, and thus the ciliated part is proportionately very much shorter in *A. americanus* Ortm. than in *A. brasiliensis*.

8. *Acetes paraguayensis* n. sp. Figs. 8—14 in the text.

The Copenhagen Museum possesses a large number of specimens collected by Dr. William Sörensen in a lagoon at Rio Paraguay near its junction with Rio Parana. A single specimen was taken by the same Zoologist in the outlet of Riacho del Oro in Rio de la Plata in feebly brackish water.

Male. — The rostrum (fig. 9) is acuminate, acute; the median crest has posteriorly a strong tooth, and between this tooth and the end of rostrum is a rudimentary denticle or at least an angular bend. Eyes rather large, nearly as in *A. vulgaris*. Antennulæ (fig. 8) with the peduncle nearly as in *A. vulgaris*, as the third joint is slightly longer than in the female and considerably less than half as long again as the inner margin of second joint; the thickened part of the upper flagellum nearly as long as third peduncular joint. Lower flagellum (figs. 10—11) has its shaft moderately short, 3-jointed; the main "branch" has its proximal part curved somewhat upwards, the four proximal joints fused so that only the most distal of the articulations is partly developed, with about 4 obtuse spines at the base on the lower side, while the third joint has a very large protuberance downwards and outwards vertically on its joint, and this protuberance is as deep as the diameter of the joint, almost as deep as broad, somewhat

compressed with the angles rounded; beyond this thicker proximal portion the flagellum contains 6 slender joints; the third joint of the shaft is a little produced below, and this protuberance has a very long, strong, a little curved spine directed forwards and reaching a little beyond the protuberance on the main "branch". Antennal squama reaches distinctly beyond the middle of third joint of the antennular peduncle. Coxæ of third pair of legs with most of the inner margin convex and no tooth at its distal end, but on the lower side of each coxa near the inner margin protrudes (as in the female, fig. 14) a large, oblong, acute process directed downwards, much forwards and a little or somewhat outwards; trochanter without any tooth at the distal inner end. Genital coxæ obliquely triangular, broader than long, with the front end sub-



Figs. 8—14. *Acetes paraguayensis* n. sp.

Fig. 8. Front part of carapace with left eye, antennula and antenna of a male.
Fig. 9. Upper front part of carapace of the same male.
Fig. 10. Lower male flagellum, from the outer side.
Fig. 11. Proximal part beyond the shaft of the same flagellum, from the inner side.
Fig. 12. Exopod of left uropod of a male.
Fig. 13. Left petasma, from behind; *a.* pars astringens, *e.* pars externa, *m.* pars media.
Fig. 14. Proximal parts of third legs and the genital area of a female.

acute, and an impression on the inner side. Exopod of uropods (fig. 12) unusually broad, about three and a half times as long as broad; the ciliated part occupies scarcely two-fifths of the outer margin, and the glabrous part terminates in a minute tooth.

The petasma (fig. 13) is most peculiar. Pars astringens (*a.*) is very broad, and its inner margin with numerous coupling hooks. Pars externa (*e.*) is an oblong plate not quite three times as long as broad, with the distal part broad and obliquely rounded. Pars media (*m.*) has its free proximal portion short with the basal margin oblique and somewhat concave; the distal half is a free plate with the lateral margins subparallel, the terminal margin somewhat oblique, a little concave at the middle, and the lateral corners are broadly rounded; this portion has no vestige of any hooks or processes, and therefore I am not quite sure that the males are really adult.

Length 19 mm.

Female. — Rostrum with crest and the eyes about as in the male. Antennulæ with second and third joints of the peduncle a little shorter but scarcely more slender than in the male; thickened part of upper flagellum as long as third joint of the peduncle; lower flagellum is somewhat longer than third peduncular joint, with about 14 joints. Antennal squama reaches the end of the antennular peduncle. Coxæ of third pair of legs nearly as in the male (fig. 14).

The genital area (fig. 14) has a somewhat small, rounded tubercle behind the produced posterior corner of each coxa; the furrow between the penultimate and the last thoracic segment is, excepting near the sides, extremely curved with the concavity turning forwards, and the area between this concave furrow and the tubercles mentioned is raised as two large and proportionately high, a little oblong, rounded knots separated by a deep median impression.

Length 21 mm.

Remarks. — *A. paraguayensis* differs from all species described in this paper in having the exopod of the uropods considerably broader in proportion to its length, and in possessing a process on the lower surface of the coxæ of third pair of legs, while in other forms a process or tooth, when it exists, projects from the distal inner corner of the coxæ. The shape of the exopod of the uropods excludes the possibility that this species could be identical with *A. americanus* Ortm. — Most of the specimens are small and decidedly immature; some among the females are certainly adult; as to the males I believe that some few specimens are adult, but as the curious petasma is without hooks, acute processes or spines on pars media, I am not absolutely certain.

It is interesting that this species has been taken in a tributary to Rio de la Plata more than a hundred geographical miles from the Atlantic.

II. Sub-Family Luciferinæ.

Lucifer Thomps.

With good reason the genus *Lucifer* J. Vaughan Thompson — or *Leucifer* H. Milne-Edw. — has been separated from the other genera of Sergestidæ and established as type for a sub-family. The general morphology is on the whole well known. In 1882 Brooks elucidated the metamorphosis of an Atlantic species, *L. Faxonii* Borrad., and the material of larval stages secured by the "Siboga" is so small that I leave this topic out of consideration. But the "Siboga" gathered enormous quantities of subadult and adult specimens, in reality a quite unique collection. To separate and name the species with the assistance of the existing literature was found to be impossible, and the result is that I was forced to work out a kind of monograph. The zoological Museum in Copenhagen possesses a good collection of this genus; the majority of the specimens was taken at a large number of localities in the tropical and the warmer temperate areas of the Atlantic, but besides specimens are to hand from Aden, the Bay of Bengal, various other places in the Indian Ocean and finally from the Bay of Yeddo, Japan. Consequently I think to possess specimens of every species inhabiting the Atlantic and the tropical seas south of Asia, but unfortunately I have almost no material from the Pacific excepting the areas from southern Japan to the Philippines, and it may be possible that the vast Pacific contains a single or two hitherto unknown forms.

Before mentioning the literature and the specific characters it may be stated that I have separated six species; even of the most rare of these form I have seen a good number of

specimens. All six species are represented in the "Siboga" collection. From the Atlantic I have only two species, *L. typus* M.-Edw., and *L. Faxonii* Borrad.; *L. typus* is extremely common in the Atlantic and scarce in the area explored by the "Siboga".

The genus was established in 1829 by J. VAUGHAN THOMPSON, who figured an Atlantic specimen, but did not name the species; in 1837 H. MILNE-EDWARDS named it *L. typus*, but had not seen any specimen. According to THOMPSON's figure it is a species with long eye-stalks, and as only one form with long-stalked eyes has been found in the Atlantic, where it is extremely common, the name *L. typus* must be kept for this species. In 1837 MILNE-EDWARDS also established a species from the Indian Ocean, *L. Reynaudii*; his figure does not allow a determination, and it is interesting to observe that DANA (1852) described and figured a species with short eye-stalks, and SPENCE BATE (1888) a species with long eye-stalks under the name *L Reynaudii*. Judging from MILNE-EDWARDS' figure I think he examined a species with long eye-stalks, but as two species with such eye-stalks exist in the Indian Ocean it will forever be impossible to produce a valid interpretation, and the name *L. Reynaudii* ought to be dropped. — In 1852 DANA described and figured 4 species, viz. a form with short eye-stalks determined as *L. Reynaudii* and three new species. Though KEMP (1913) says: "DANA's treatment is fortunately very good and surpasses that of nearly all subsequent writers", I must unfortunately maintain that it is poor. What DANA described and figured as *L. Reynaudii* is one of the forms with short eye-stalks, but it is impossible to recognize it. KEMP believes that a feature seen by DANA, viz. the presence of a pair of spinules on sixth abdominal segment of the male, is a valid specific character, but it is no character; these spinules are those always present in the females and generally lost in the males, but I have found them in single specimens of *L. Faxonii* and *L. Hanseni* Nobili. DANA's new species *L. acestra* is decidedly one of the two species with long eye-stalks, it is a male, and if the figure exhibiting the telson is not very incorrect the specimen drawn was not quite full-grown and, judging from the place of the protuberance on the lower side of telson and especially from the shape of the posterior ventral process on sixth abdominal segment, the specimen in question belonged to *L. typus* M.-Edw. Of the two other species established by DANA as new *L. pacificus* is completely unrecognizable, while *L. acicularis* is a quite young, not even half-grown specimen still showing two larval characters, viz. the very short "neck" and the telson nearly as long as the uropods. — In 1905 NOBILI established and in 1906 he described more elaborately and figured a new species with short eye-stalks, *L. Hanseni*, which can be recognized with certainty, as he pointed out in the text and showed in the figures two characters, in which this species differs from all others known to me; his animals were taken in the Bay of Djibouti (the Red Sea).

So many species had been established in 1914. Several other authors, viz. EYDOUX & SOULEYET, CLAUS, DOHRN, SEMPER, FAXON, BOAS, ORTMANN, BROOKS and KEMP, had mentioned or even published figures of *Lucifer*, referring their specimens with or without a query to *L. typus* or *L. Reynaudii*, or distinguishing the form only as *Lucifer sp.* or *Lucifer sp.* n.? Some few of these publications, especially those worked out by CLAUS and BROOKS, give important contributions to our knowledge of the type, but for discrimination between forms they are of slight or no significance. — In 1915 L. A. BORRADAILE published a treatise: "On the Species

of *Lucifer* and their Distribution", in which he gave a tabular view of the forms, and besides synonymy with notes on each species. The material examined by him seems to have been proportionately small, and many of the characters used in the key are based on the figures or descriptions in the literature. But most of these characters are either wrong or for some other reason of slight or no value. He adopts *L. Reynaudii* M.-Edw. and the three species established by DANA, even *L. acicularis* based on semi-larval characters; furthermore he describes a new species, *L. inermis*, which is only a synonym to *L. Hanseni* Nobili (he had overlooked NOBILI's above-named paper, but in 1916 in another paper he withdraws *L. inermis* as a synonym); finally he establishes 5 new species on differences in the descriptions or figures published by earlier authors; the result is that he has in all 11 species. As J. V. THOMPSON has figured a *Lucifer*, and DANA's *L. acestra* is without any rostrum, he considers this feature as a real specific character, though it is only an error, as a rostral process is always well developed in my immense material. The shape of the terminal part of the exopod of the uropods differs according to sex, and besides it exhibits some individual variation, so that this part cannot be used as a character in the way applied by BORRADAILE in his key. Errors in earlier figures as to length of the thoracic legs are also used as characters. Among his five new species based on the literature only one can be accepted, viz. *L. Faxonii* Borrad., because it can be recognized, as it is the only species with short eye-stalks inhabiting the Atlantic, at least north of the line.

Of the 12 species established in the whole literature only 3 can be adopted, viz. *L. typus* M.-Edw., *L. Faxonii* Borrad., and *L. Hanseni* Nobili. *L. typus* has long and *L. Faxonii* short eye-stalks, and both were founded on specimens taken in the Atlantic north of the line, where no other form of the genus lives; *L. Hanseni* (*L. inermis* Borr.) can be recognized by NOBILI's figure. All the remaining names in the literature must be cancelled forever either as synonyms or as quite unrecognisable. As already mentioned I have in all 6 species, 3 of which I must name.

Every adult male can be determined with absolute certainty, as the structure of the petasma affords excellent specific characters. Adult females of two species can always be determined with certainty, but I have not been able to find any really sharp character between females of the two species with long eye-stalks or between the females of two of the four species with short eye-stalks, viz. *L. penicillifer* n. sp. and *L. intermedius* n. sp.; yet it may be added that the majority of the females of the two last-named species can be separated, but some females of the two species are closely similar. More than half-grown but immature specimens can generally be determined, when adult females of the same forms can be separated. The "Siboga" frequently captured specimens of three or four species in the same haul. The analytical keys and the description of the species may elucidate sufficiently the specific characters, differences according to sex and individual variation; only the male petasma must be described here.

The petasma is fixed on the inner side of the peduncle of the pleopod (Pls. IV and V, several figures); it projects forwards and obliquely downwards as a somewhat thick plate, and its distal part is obliquely folded strongly inwards and besides directed a little downwards. The

basal portion of this incurvate part is broad, while its terminal portion is moderately or very narrow (f. inst. Pl. V, figs. 1*e*, 2*g*, 3*g*, 4*l*), and it lies obliquely or nearly transversely on the inner side of the pleopod, in the main or wholly beyond the fixed part of the petasma. The result is that when the animal lies on the right side, thus turning the left side upwards, it is impossible to see half or more than half of the petasma of left pleopod, as both its broad proximal part and its terminal more or less narrow portion is covered by the peduncle of the pleopod. As the shape of the narrow portion of the petasma is of the highest importance for determining the species, and this ought to be possible without damaging the specimen by cutting off one of the pleopods of first pair, I may advise the student to place the male in some drops of water on an object glass so, that its right side is turned upwards, and then with a needle to discard the first right pleopod backwards or forwards, so that the inner side of left petasma and especially its narrow part is freely seen from above, and then to look on its shape under a magnifying power of 140 or 150 times. When one has acquired some experience, an examination of this simple kind will be sufficient for determining instantly every adult male in comparing the shape of the narrow portion of the petasma with my figures. But when an investigation of the whole structure of this narrow portion shall be undertaken it is necessary to remove the pleopod, partly unfold the petasma so that its narrow portion is directed considerably forward or nearly parallel with the pleopod (Pl. IV, figs. 6*g* and 7*e*; Pl. V, fig. 4*m*), and undertake a partial dissection of the narrow portion under a simple microscope magnifying about 100 times.

In comparing the petasma with those in *Sergestes* or *Sicyonella* great differences are seen. Of the three main-parts observed in these genera two, viz. pars externa and pars astringens, are completely wanting in *Lucifer*, while pars media, which in *Sergestes*, *Sicyonella* and *Acetes* is fixed by a somewhat short, proportionately narrow stalk, has in *Lucifer* no such stalk, but an extremely broad basal pars lying flatly on the inner side of the pleopod. The narrow terminal portion answers to the distal third or two-fifths of pars media in *Sergestes*. In all species of *Lucifer* the narrow portion constitutes a kind of sheath open on the side and enclosing a well chitinized element (*pv.* in many figures on Pls. IV and V) which I think is homologous with processus ventralis in *Sergestes* and most species of *Acetes*. In two species, *L. Faxonii* and *L. Hanseni*, this process is shaped as a long, acute needle (Pl. V, figs. 3*h*—3*i*, figs. 4*n*—4*o*); in *L. penicillifer* it is broader (Pl. V, figs 2*i*—2*k*), distally shaped as an oblong, concave lamella with its bifid end adorned with numerous short chitinous threads, so that a bipartite brush is formed. In *L. intermedius* processus ventralis is a narrow, robust plate (Pl. V, figs. 1*f*—1*g*, *pv.*) distinctly widened near the end which is deeply cleft. In *L. typus* and *L. orientalis* the same process is a somewhat broad plate (Pl. IV, figs. 6*h* and 6*k*, figs. 7*f*—7*g*, *pv.*) with its distal half widened and cleft by a long and deep incision differently shaped in the two species. The sheath is rather simple in *L. Faxonii* and *L. Hanseni*, where it is oblong conical, somewhat curved (Pl. V, figs. 3*g*—3*h*, figs. 4*m*—4*n*) with the end more or less acute, and its side opposite the base is well chitinized (*ch.*), while the proximal side is so membranous that it is easily overlooked. In *L. penicillifer* the membranous part (Pl. V, figs. 2*g*—2*h*, *m.*) of the sheath shows an angle and is not easily perceived; the distal part of the sheath is well chitinized

(Pl. V, figs. 2*g*—2*i*, *ch.*) and much of it scabrous from numerous small, sharp knots; besides it is slender with the end distinctly expanded and oblique. In *L. intermedius* the well chitinized part of the sheath has its end broadly rounded, and somewhat before the end on the side opposite the base of the petasma two plate-shaped, rather conspicuous protuberances (*l.* in Pl. V, figs. 1*e*, 1*f*, 1*g*), and on the distal part of inner surface a number of nearly regular, transverse, very fine but conspicuous lines (*s.* in fig. 1*f*). In *L. typus* and *L. orientalis* the terminal part of the petasma is considerably thicker than in the four other species; in *L. typus* (Pl. IV, figs. 6*g*—6*h*) its rather broad end is obtuse with a nearly rudimentary, triangular protuberance; in *L. orientalis* (Pl. IV, figs. 7*e*—7*f*) the end is broad and divided into three triangular lobes; in both species nearly more than the distal third of the inner surface is adorned with transverse, conspicuous lines (*s.*). In *L. typus* the sheath encloses not only the above-named plate-shaped processus ventralis, but besides a long, well chitinized, stick-shaped process (Pl. IV, figs. 6*h* and 6*k*, *h.*), which has its distal part strongly bent so that the process is a hook with a long shaft and the end very acute; I am unable to interpret the morphological equivalence of this hook which does not exist in the five other species. The figures and the explanation of the plates will add various particulars and help to the understanding of the brief description given.

In all species a protuberance is observed on the front margin of the first male pleopod slightly beyond the petasma. The shape of this protuberance (*p.* in Pl. IV, figs. 6*g* and 7*e*, Pl. V, figs. 1*e*, 2*g*, 3*g*, 4*l*, 4*m*) and its equipment with prickles on the end is not without specific value.

The 6 species may be divided into two groups, separated by some characters.

A. Distance between the labrum and the insertion of the eye-stalks somewhat or only a little longer than the eye-stalks with eyes (the basal short joint of the stalks included). Posterior ventral process on sixth abdominal segment in the male with its distal part swollen. Terminal portion of the petasma moderately thick, and the processus ventralis shaped as a somewhat broad plate without any terminal brush.

B. Distance between the labrum and the insertion of the eye-stalks almost twice or more than twice as long as the eye-stalks with eyes. Posterior ventral process on sixth abdominal segment tapers to the narrow, obtuse end. Terminal portion of the petasma rather or very slender, and the processus ventralis never shaped as a somewhat broad plate without brush, but either slender or terminating in a bipartite brush.

Group A.

The animals of this section differ in aspect very considerably from those of group B by the long eye-stalks. These stalks have besides their major part very slender; the eyes are conspicuously larger than in group B, and larger in the males than in the females. The exopod of the uropods is very narrow, in the males from more than five to six times as long as broad, in the females from five to somewhat more than five times as long as broad.

The group comprises only 2 species. While I have been unable to find any sufficiently sharp difference between the females of these species, their males are extremely easy to separate by the following key.

a. On the telson the posterior margin of the large ventral protuberance is somewhat remote from the end of the telson, and the same is the case with the distal pair of dorsal spines. The petasma has the end rather broad and obtuse, at most with a rudimentary protuberance; the plate-shaped processus ventralis has the bottom of its deep terminal incision transverse, and the sheath encloses besides a long-stalked hook. . . . . *L. typus* H. M.-Edw.

b. On the telson the posterior margin of the big ventral protuberance is near the end of the telson, and the same is the case with the distal pair of dorsal spines. The petasma is at its end proportionately broad and produced into three triangular lobes; the plate-shaped processus ventralis has the terminal incision extremely deep and tapering to the acute end, and the sheath encloses no hook. . . *L. orientalis* n. sp.

1. *Lucifer typus* H. M.-Edw. Pl. IV, figs. 6*a*—6*k*.

1829. *Lucifer* J. Vaughan Thompson, Zool. Researches, IV, p. 58, Pl. VII, fig. 2.
1837. *Leucifer typus* H. Milne-Edwards, Hist. Nat. Crust. T. II, p. 469.
1852. *Lucifer acestra* Dana, U. S. Expl. Exped. Crust. I, p. 671, Pl. XLIV, figs. 9, *a*—*i*. [At least partim].
1871. ? *Lucifer Reynaudi* Dohrn, Zeitschr. wiss. Zool. Bd. XXI, p. 357, Taf. XXVII, Fig. 1—10.
1882. *Lucifer Reynaudii* Bate, Challenger Rep., Zool., Vol. XXIV, p. 466, Pl. LXXXIV. [At least partim].

Borradaile, in Ann. Mag. Nat. Hist. ser. 8, Vol. XVI, p. 227—230 (1915), has the following four names: *L. typus* H. M.-Edw., *L. acestra* Dana, *L. Clausi* Borrad. and *L. Batei* Borrad., all referring to figures of *L. typus*, while two of the authors quoted have in all probability, judging from their lists of localities, mixed up specimens of *L. typus* and *L. orientalis*.

Stat. 128. July 22. Lat. 4° 27′ N.. long. 125° 25′.7 E. 1645 m. Hensen vertical net, from 700 m. to surface. 16 specimens (♂ and ♀).
Stat. 129. July 22—23. Anchorage off Kawio- and Kamboling-islands, Karkaralong-group. 23—31 m. 5 specimens (♂ and ♀).
Stat. 133. July 25. Anchorage off Lirung, Salibabu-island. Depth up to 36 m. 2 males (and females together with both sexes of *L. orientalis*).
Stat. 194. Sept. 15. Lat. 1° 53′.5 S., long. 126° 39′ E. 1504 m. Townet. 5 specimens (♂ and ♀).

Description. — The distance between labrum and the insertion of the eye-stalks is about one-seventh as long again as eye-stalks with eyes; the major part of these stalks is very slender, and the large eyes conspicuously larger in the males than in the females. The anterior ventral process on sixth abdominal segment in the male (fig. 6*a*) is almost as long as the posterior, slender, while the swollen distal part of the posterior process is bent considerably upwards. In the male telson (fig. 6*e* and 6*f*) the ventral protuberance is directed downwards and slightly or conspicuously forwards; the lower margin behind the protuberance is more than half as long as the protuberance itself, and the posterior pair of dorsal spines on the telson are placed above or slightly beyond the posterior margin of the protuberance, so that these spines are rather removed from the conspicuous outer pair of terminal spines. — The exopod

of the uropods differs as usual in the two sexes. In the male (figs. 6*a*—6*c*) it is from a little more than five to more than five and a half times as long as broad, and the apical marginal process is moderately long or very long, but the terminal part of the uropod shows yet considerable individual variation, as sometimes the end of the uropod has its margin somewhat flatly curved, which is the case when the marginal process exhibits itself nearly as a continuation of the uropod, while sometimes the end of the uropod has the margin deeply curved, and in this case the process originates a little before the terminal upper angle of the uropod; forms intermediate between the two shapes described are common. In the female the exopod is five times as long as broad; its end (fig. 6*d*) is oblique so that the marginal spine, which is smaller than in the males, originates slightly or somewhat before the upper terminal angle of the uropod, and reaches to or a little beyond that angle.

The petasma is shown in fig. 6*g* from the inner side and partly unfolded, so that its terminal portion is removed from the pleopod. This terminal portion is seen to be proportionately robust as compared with its shape in the forms figured on Pl. V; in fig. 6*h* it is shown with transmitted light, and the shading is made according to the degree of chitinization. The end is broad, flatly and obliquely rounded with a rudimentary protuberance; the long hook (*h*) is very conspicuous, and the lamelliform processus ventralis (*pv.*) rather distinct. Fig. 6*i* exhibits the same portion, but the proc. ventralis has been removed. The transverse, undulating, fine, dark lines are distinct on both figures. Fig. 6*k* exhibits the terminal portion of a third specimen; the lamelliform proc. ventralis is turned out of the sheath; a special description of this process is scarcely needed, and only one thing may be emphasized, viz. that the bottom of the deep terminal incision is transverse. The process at the front margin of the pleopod beyond the insertion of the petasma is seen (fig. 6*g*) to be slender, much longer than thick, with two or three sometimes nearly indistinct prickles on the rounded end.

Length of a large male (from the tropical Atlantic) 12.4 mm., of a large female 12 mm.

Distribution. — *L. typus* is evidently far from common in the "Siboga" area, as it was taken only at four places, and three among these are even rather near each other. The Copenhagen Museum possesses it from Manilla ("Galathea"); from lat. 16° 8′ S., long. 111° 50′ E. (Capt. Andréa), and from the Bay of Bengal ("Galathea"); furthermore from more than thirty localities in the Atlantic, and from Messina. Of the Atlantic places more than twenty five are north of the line, the most northern at lat. 34° 10′ N., long. 42° 10′ W.; the two most southern localities are respectively lat. 28° 43′ S., long. 25° 14′ W., and lat. 40° 32′ S., long. 52° 2′ W. As our Museum possesses such a rich material from so many places in the Atlantic, and I did not find a single male specimen of the other species with long eye-stalks among the material from this Ocean, I think that all specimens referred to *L. reynaudi* M.-Edw. (*L. acestra* Dana) by Ortmann (1893) and taken by the German Plankton-Expedition belong to *L. typus*. Ortmann says that it is "eine echte Plankton-Form, die sich nur in den wärmeren Meeren findet, dort aber so allgemein verbreitet ist, dass sie fast in allen Fangen erhalten wurde"; he enumerates an enormous number of stations where it has been gathered, and his Taf. X, a track-chart of the expedition, shows its quantitative occurrence; the most northern of the stations is in the Florida current far south of New Foundland about at lat. 42° N.

As no author has separated the two species of this group from one another, and as *L. orientalis* is much more common in the Indian Ocean than *L. typus*, all localities found in the literature on the occurrence of a species with long eye-stalks in that Ocean or in the Pacific must be discarded as without value.

2. *Lucifer orientalis* n. sp. Pl. IV, figs. *7a—7g*.

Stat. 37. March 30—31. Sailus Ketjil, Paternoster-islands. 27 m. and less. 24 specimens.
Stat. 66. May 7—8. Bank between islands of Bahuluwang and Tambolungan, south of Saleyer. 8—10 m. Plankton. 12 specimens.
Stat. 81. June 14. Pulu Sebangkatan, Borneo-bank. 34 m. Plankton. 2 specimens.
Stat. 104. July 2—3. Sulu-harbour, Sulu-island. 14 m. Townet. 1 specimen.
Stat. 106. July 4. Anchorage off Kapul-island, Sulu-archipelago. 13 m. Townet. 4 specimens.
Stat. 133. July 25. Anchorage off Lirung, Salibabu-island. Depth up to 36 m. 2 males (and females together with *L. typus*).
Stat. 136. July 29—Aug. 3. Ternate anchorage. 23 m. Townet, surface. 60 specimens.
Stat. 138. August 3. Anchorage on the east coast of Kajoa-island. 66 m. Townet, surface. 8 specimens.
Stat. 140. Aug. 4—5. Bay of Batjan. 13 m. Townet. 3 specimens (♂, ♀).
Stat. 141. August 5. Lat. 1° 0′.4 S., long. 127° 25′.3 E. 1950 m. HENSEN vertical net, from 1500 m. depth to surface. 10 specimens.
Stat. 143. Aug. 7. Lat. 1° 4′.5 S., long. 127° 52′.6 E. 1454 m. HENSEN vertical net, from 1000 m. to surface. 1 male.
Stat. 148. Aug. 10. Lat. 0° 17′.6 S., long. 129° 14′.5 E. 1855 m. HENSEN vertical net, from 1000 m. depth to surface. 1 female.
Stat. 157. Aug. 15—16. Lat. 0° 32′.9 S., long. 130° 14′.6 E. 45 m. Townet. 1 male, 1 female.
Stat. 177a. Sept. 1. Lat. 2° 30′ S., long. 129° 28′ E. Townet. 2 females.
Stat. 189a. Sept. 12. Lat. 2° 22′ S., long. 126° 46′ E. Townet. 7 specimens.
Stat. 194–197. Sept. 15. Lat. 1° 53′.5–1° 45′.3 S., long. 126° 39′–127° 8′.3 E. Plankton. 2 males.
Stat. 203. Sept. 19. Lat. 3° 32′.5 S., long. 124° 15′.5 E. HENSEN vertical net, from 1500 m. depth to surface. Numerous specimens.
Stat. 220. Nov. 1—3. Anchorage off Pasir Pandjang, west coast of Binongka. 278 m. Townet, surface. 20 specimens.
Stat. 225. Nov. 8. 5700 m. N. 279° E. from Southpoint of South-Lucipara-island. 894 m. Horizontal cylinder. 9 specimens.
Stat. 243. Dec. 2. Lat. 4° 30′.2 S., long. 129° 25′ E. HENSEN vertical net, from a depth of 1000 m. to surface. 1 female.
Stat. 245. Dec. 3. Lat. 4° 16.5 S., long. 130° 15′.8 E. Townet, surface. 4 specimens.
Stat. 276. Jan. 9. Lat. 6° 47′.5 S., long. 128° 40′.5 E. HENSEN vertical net, from 750 m. to surface. 7 specimens.
Near Stat. 300. Between Timor and Lomblen. Plankton. 4 specimens (♂, ♀).

Description. — Very similar in aspect to *L. typus*. The eye-stalks are still slightly longer, as the distance between their insertion and the labrum is only about one-tenth as long again as eye-stalks with eyes. The ventral processes on sixth abdominal segment in the male (fig. *7a*) about as in *L. typus*, excepting that the swollen distal half of the posterior process is bent feebly upwards, conspicuously less than in *L. typus*. The male telson (fig. *7d*) has the ventral protuberance more semiglobular with the middle part of its lower margin more convex than in *L. typus*, furthermore the lower margin of the telson behind the protuberance is very short, twice or three times shorter than in *L. typus*, and the posterior pair of dorsal spines are situated

only a little in advance of the outer terminal spines. The exopod of the uropods is in the male (fig. 7*a*) a little more narrow than in *L. typus*, about six times as long as broad, and the marginal process is frequently still more produced (fig. 7*b*) than in *L. typus*. In the female the exopod is a little or somewhat more than five times as long as broad; its end is sometimes shaped as in *L. typus*, sometimes the terminal margin is considerably oblique (fig. 7*c*), and then the marginal spine reaches almost or fully as far backwards as the upper distal angle.

The petasma (fig. 7*e*) has the terminal portion thicker than in *L. typus*, and it terminates in three triangular lobes. Fig. 7*f*, drawn with transmitted light, exhibits these lobes, the fine transverse lines (*s.*) on the two largest lobes, furthermore the enclosed processus ventralis (*pv.*). In fig. 7*g* the sheath is seen from another side, open, and the processus ventralis is turned totally out and bent backward; this rather broad, lamellar process differs considerably from that in *L. typus* in having the terminal incision much deeper and narrowing to its acute end; the long hook-shaped process found in *L. typus* is entirely wanting. The process at the front margin of the pleopod beyond the insertion of the petasma is nearly as in *L. typus*, but with some more prickles on its end.

Length of good-sized specimens of both sexes 11.5 mm.

Distribution. — The list of the localities shows that *L. orientalis* has been taken at more than twenty stations; it is thus much more common in the "Siboga" area than *L. typus*, but in most cases the number of specimens is small. The Copenhagen Museum possesses *L. orientalis* from two places, viz. Manilla ("Galathea") and Aden (Mr. H. MORTENSEN); the last-named locality, at the entrance to the Red Sea, is of interest.

Group B.

The animals belonging to this section differ in aspect very considerably from those of group A by the proportionately short eye-stalks (Pl. IV, fig. 8; Pl. V, figs. 2*a*, 3*a*, 4*a*). These are sometimes rather slender to somewhat from the eyes, but most frequently they are moderately or decidedly inverted conical; the eyes are smaller in proportion to the animal than in group A, and only slightly or not at all larger in the males than in the females. The exopod of the uropods differs in breadth according to species and sex, from slightly more than five to only four times as long as broad.

The group comprises 4 species. The females of two of the species, *L. Faxonii* and *L. Hanseni*, can be separated from one another and from the two other species, *L. intermedius* and *L. penicillifer*, but it is sometimes impossible to separate with certainty females of the two last-named species. — The following keys may be useful for students of the genus.

Key to the Males.

a. Terminal portion of the petasma has the end broadly rounded, a number of fine transverse lines on the inner side of its distal part, and two freely protruding, very conspicuous, small plates at the front margin. Proc. ventralis is a narrow plate with its broader terminal

part deeply incised, but with any brush. (First antennular joint at most reaching the front margin of the eyes and generally distinctly shorter) . . . . . *L. intermedius* n. sp.

b. Terminal portion of the petasma has the end distinctly expanded as a kind of oblique plate, the distal part has no transverse lines and no protruding plates, but its convex proximal side is scabrous from small, transverse, sharp knots. Proc. ventralis is a moderately slender plate terminating in a more or less distinctly bipartite brush. (First antennular joint reaches at most slightly beyond the front margin of the eyes, and is generally a little shorter, not reaching to that margin) . . . . . *L. penicillifer* n. sp.

c. Terminal portion of the petasma with the end acute, and no transverse lines or protruding plates or scabrousness. Proc. ventralis is a slender needle with acute end.

α. Exopod of uropods with the marginal process reaching beyond the upper terminal angle. (First antennular joint overreaches conspicuously the eyes) . . . . . *L. Faxonii* Borrad.

β. Exopod of uropods with the dentiform marginal process terminating conspicuously and generally far before the upper terminal angle. (First antennular joint about as long as or a little longer than the eyes) . . . . . *L. Hanseni* Nobili.

Key to the Females.

a. Exopod of uropods from somewhat more than four to a little less than five times as long as broad; the marginal spine terminates only somewhat or a little before the distal upper angle or even beyond that angle.

α. First antennular joint reaches at most a little and most frequently not beyond the eyes . . . . . *L. intermedius* n. sp., and *L. penicillifer* n. sp.

β. First antennular joint reaches considerably beyond the eyes . *L. Faxonii* Borrad.

b. Exopod of uropods somewhat broad, only about four times as long as broad; its marginal tooth terminates very considerably before the distal upper angle . . . . . *L. Hanseni* Nobili.

3. *Lucifer intermedius* n. sp. Pl. IV, figs. 8*a*—8*b*; Pl. V, figs. 1*a*—1*g*.

Stat. 7. March. 11. Lat. 7° 55′.5 S., long. 114° 26′ E. 15 m. and more. 5 specimens.
Stat. 35. March 28. Lat. 8° 0′.3 S., long. 116° 59′ E. 1310 m. Surface. 15 specimens.
Stat. 37. March 30—31. Sailus ketjil, Paternoster-islands. 27 m. and less. Surface. Numerous specimens.
Stat. 66. May 7—8. Bank between islands of Bahuluwang and Tambolungan, south of Saleyer. 8—10 m. Large number of specimens.

Stat. 75. June 8. Lat. 4° 57′.4 S., long. 119° 2′.8 E. 18 m. HENSEN vertical net, from 11 m. to surface; electric light in net. 4 specimens.
Stat. 81. June 14. Pulu Sebangkatan, Borneo-bank. 34 m. Plankton. 4 specimens.
Stat. 106. July 4. Anchorage off Kapul-island, Sulu-archipelago. 13 m. Plankton. 1 specimen.
Stat. 109. July 5—6. Anchorage off Pulu Tongkil, Sulu-archipelago. 13 m. Plankton. 3 specimens.
Stat. 117a. July 12. Lat. 1° 15′ N., long. 123° 37′ E. Townet. Many specimens.
(? Stat. 132). July 25. About Lat. 5° 56′.7 N., long. 126° 25′ E. Townet. Many specimens.
Stat. 136. July 29—Aug. 3. Ternate anchorage. 23 m. Plankton. 12 specimens.
Stat. 138. Aug. 13. Anchorage on the east coast of Kajoa-island. 66 m. Plankton. 10 specimens.
Stat. 141. Aug. 5. Lat. 1° 0′.4 S., long. 127° 25′.3 E. HENSEN vertical net, from 1500 m. depth to surface. 3 specimens.
Stat. 144. Aug. 7—9. Anchorage North of Salomakiëe-(Damar-)island. 45 m. Plankton. 3 specimens.
Stat. 157. Aug. 15—16. Lat. 0° 32′.9 S., long. 130° 14′.6 E. Townet, 4 specimens.
Stat. 177a. Sept. 1. Lat. 2° 30′ S., long. 129° 28′ E. Townet. 13 specimens.
Stat. 189a. Sept. 12. Lat. 2° 22′ S., long. 126° 46′ E. Townet. 11 specimens.

Description. — The distance between the labrum and the insertion of the eye-stalks about, or slightly more than, twice as long as the stalks with eyes; the stalks are not conical but subcylindrical to somewhat before the eyes (fig. 8*a*). First antennular joint at most reaching the anterior margin of the eyes, generally distinctly shorter. On sixth abdominal segment (fig. 1*a*) the first ventral process is as long as, or generally somewhat or much shorter than, the second, very acute, a little curved and placed about mid-way between the base of the segment and second process; the latter tapers to the rather narrow, obtuse end. Telson in the male (fig. 8*b*) differs considerably from those in group A in having the ventral protuberance much smaller; this protuberance is directed downwards and only a little or slightly backwards. Exopod of uropods in the male (fig. 1*a*) five or a little more than five times as long as broad; the short terminal margin is transverse or a little oblique (figs. 1*b* and 1*c*), because the marginal process, which varies much in length, originates a little in front of or below the upper distal angle of the exopod, and the process overreaches somewhat or very much the transverse hind margin. In the female the exopod is a little broader, not fully five times as long as broad; the terminal margin is rather oblique (fig. 1*d*), and the marginal process terminates below or a little before the upper distal angle of the exopod.

The petasma (figs. 1*e*—1*g*) has the terminal portion rather narrow and very peculiar. The end is broadly rounded without any protuberance, but on the distal lateral margin two protuberances are very conspicuous, the proximal much broader than the distal, and at a closer investigation, especially when the organ is examined from in front (fig. 1*g*), each protuberance (*l.*) is seen to be a freely protruding, obliquely inserted plate with its free margin almost semicircular; the distal part of the inner side of the terminal portion is adorned with a good number of fine but very distinct transverse lines (fig. 1*e*, and especially fig. 1*f*, *s.*) about as in the species of group A. The processus ventralis (*pv.*) is a very long, narrow plate with its distal part somewhat widened, and its end is deeply and broadly incised with the bottom of the incision rounded, and without any brush. The process (*p.*) on the front margin of the pleopod beyond the petasma is slender with a few prickles on the end.

Length of a male 10.3 mm., of a female 11 mm.

Remarks. — The name *L. intermedius* is given to this species, as it, though belonging in general aspect and most characters to group B, has in the petasma the distally deeply incised processus ventralis, and especially the transverse lines on the distal inner side of its terminal portion. Besides, the eye-stalks are not conical as f. inst. in *L. Faxonii*, and the exopod of the uropods is somewhat narrow. The male resembles that of *L. Faxonii* and differs from the two other species of this group in having on the exopod of the uropods the marginal process or tooth conspicuously or much overreaching the upper distal angle of the exopod; the female can frequently, but sometimes not, be distinguished with absolute certainty from every female of *L. penicillifer*.

Distribution. — According to the list of localities this species is rather common in the major part of the "Siboga" area. The Copenhagen Museum possesses it from lat. 0° 14′ N., long. 107° 6′ E. (Capt. ANDRÉA); Chinese Sea, Hongkong—Shanghai ("Galathea"), and a good number from the Gulf of Yeddo, Japan ("Galathea").

4. *Lucifer penicillifer* n. sp. Pl. V, figs. 2*a*—2*k*.

Stat. 7. March 11. Lat. 7° 55′.5 S., long. 114° 26 E. 25 m. and more. 11 specimens.
Stat. 16. March 15—16. Bay of Kankamaräan, S. coast of Kangeang. 22 m. Electric light in vertical net. 15 specimens.
Stat. 35. March 28. Lat. 8° 0′.3 S., long. 116° 59′ E. Surface. Numerous specimens.
Stat. 37. March 30—31. Sailus ketjil, Paternoster-islands. 27 m. and less. Large number of specimens.
Stat. 40. April 2. Anchorage off Pulu Kawassang, Paternoster-islands. 12 m. Townet. 2 specimens.
Stat. 66. May 7—8. Bank between Bahuluwang and Tambolungan, South of Saleyer. 8—10 m. Plankton. Large number of specimens.
Stat. 81. June 14. Pulu Sebangkatan, Borneo-bank. 34 m. Plankton. 8 specimens.
Stat. 93. June 24—25. Pulu Sanguisiapo, Tawi-Tawi-islands, Sulu-archipelago. 12 m. Plankton. (night). 1 specimen.
Stat. 96. June 27. South-east side of Pearl-bank, Sulu-archipelago. Townet. About 30 specimens.
Stat. 98—99. June 28—30. Lat. 6° 9′—6° 7′.5 N., long. 120° 21′—120° 26′ E. Townet. Numerous specimens.
Stat. 99. June 28—30. Lat. 6° 7′.5 N., long. 120° 26′ E. 16—23 m. Surface. Numerous specimens.
Stat. 105. July 4. Lat. 6° 8′ N., long. 121° 19′ E. 275 m. Plankton. Many specimens.
Stat. 106. July 4. Anchorage off Kapul-island, Sulu-archipelago. 13 m. Townet. Large number of specimens.
Stat. 107. July 5. Lat. 6° 1′.5 N., long. 121° 28′ E. 1 specimen.
Stat. 109. July 5—6. Anchorage off Pulu Tongkil, Sulu-archipelago. 13 m. Townet. Many specimens.
Stat. 112. July 7. Lat. 3° 1′ N., long. 122° 2′ E. Horizontal cylinder. 2 specimens.
Stat. 117a. July 12. Lat. 1° 15′ N., long. 123° 37′ E. Townet. Numerous specimens.
Stat. 125. July 18—19. Anchorage off Sawan, Siau-island. 27 m. 4 specimens.
Stat. 128. July 22. Lat. 4° 27′ N., long. 125° 25′.7 E. HENSEN vertical net, from 700 m. to surface. 3 specimens.
Stat. 136. July 29—Aug. 3. Ternate anchorage. 23 m. Townet. Many specimens.
Stat. 138. Aug. 3. Anchorage on the east coast of Kajoa-island. 66 m. Townet. Large number of specimens.
Stat. 140. Aug. 4—5. Bay of Batjan. 13 m. Townet. About 25 specimens.

Stat. 141. Aug. 5. Lat. 1° 0′.4 S., long. 127° 25′.3 E. 1950 m. HENSEN vertical net, from 1500 m. to surface. Many specimens.
Stat. 143. Aug. 7. Lat. 1° 4′.5 S., long. 127° 52′.6 E. 1454 m. HENSEN vertical net, from 1000 m. depth to surface. 6 specimens.
Stat. 144. August 7—9. Anchorage north of Salomakiëe-(Damar-)island. 45 m. Townet. Large number of specimens.
Stat. 146. Aug. 9. Lat. 0° 36′ S., long. 128° 32′.7 E. 512 m. Townet. 3 specimens.
Stat. 157. Aug. 15—16. Lat. 0° 32′.9 S., long. 130° 14′.6 E. 45 m. Townet. 4 specimens.
Stat. 165. Aug. 20—22. Anchorage on North-east side of Daram-island, East coast of Misool. 49 m. Townet. Numerous specimens.
Stat. 168. Aug. 22—23. Anchorage North of Sabuda-island. 63 m. Townet. Many specimens.
Stat. 174. Aug. 28—29. Waru-bay, North coast of Ceram. 18 m. Townet. 8 specimens.
Stat. 177a. Sept. 1. Lat. 2° 30′ S., long. 129° 28′ E. Townet. Large number of specimens.
Stat. 184. Sept. 11—12. Anchorage off Kampong Kelang, South coast of Manipa-island. 36 m. Townet. Many specimens.
Stat. 185. Sept. 12. Lat. 3° 20′ S., long. 127° 22′.9 E. HENSEN vertical net, from 1536 m. to surface. 23 specimens.
Stat. 189a. Sept. 12. Lat. 2° 22′ S., long. 126° 46′ E. Townet. Many specimens.
Stat. 194. Sept. 15. Lat. 1° 53′.5 S., long. 126° 39′ E. Townet. Many specimens.
Stat. 194—197. Sept. 15. Lat. 1° 53′.5—1° 45′.3 S., long. 126° 39′—127° 8′.3 E. Plankton. 4 specimens.
Stat. 203. Sept. 19. Lat. 3° 32′.5 S., long. 124° 15′.5 E. HENSEN vertical net, from 1500 m. to surface. 9 specimens.
Stat. 206. Sept. 21. Buton-strait. Surface. 4 specimens.
Stat. 220. Nov. 1—3. Anchorage off Pasir Pandjang, West coast of Binongka. 278 m. Townet. 6 specimens.
Stat. 225. Nov. 8. 5700 m. N. 279° E. from Southpoint of South-Lucipara-island. 894 m. Horizontal cylinder. Many specimens.
Stat. 243. Dec. 2. Lat. 4° 30′.2 S., long. 129° 25′ E. HENSEN vertical net, from 1000 m. to surface. 1 specimen.
Stat. 245. Dec. 3. Lat. 4° 16′.5 S., long. 130° 15′.8 E. Townet. Many specimens.
Near Stat. 300. Between Timor and Lomblen. Plankton. 4 specimens.
Stat. 315. Febr. 17—18. Anchorage East of Sailus Besar, Paternoster-islands. Surface. 6 specimens.

Description. — The distance between labrum and the insertion of the eyes is more than twice as long as eye-stalks with eyes; the stalks either shaped as in *L. intermedius* or somewhat conical (fig. 2 *a*). First antennular joint reaches at most slightly beyond the eyes, but generally it is a little shorter, not reaching the front margin of the eyes. Sixth abdominal segment in the male (fig. 2 *b*) nearly as in the preceding species. Exopod of uropods in the male (fig. 2 *b*) a little less slender than in *L. intermedius*, about four and a half times as long as broad; its terminal margin (figs. 2 *c* and 2 *d*) is somewhat or considerably oblique, and the marginal process is a moderately long or short triangular tooth not reaching beyond the upper distal angle of the exopod and generally terminating a little or somewhat before it. In the female the exopod is generally between four and four and a half times as long as broad; its terminal margin (fig. 2 *e*) is considerably or very oblique, and the marginal tooth as in the male.

The petasma (figs. 2 *g*—2 *i*) is instantly distinguished from that in any other species by the peculiar shape of its terminal portion. The membranous part (*m.* in figs. 2 *g* and 2 *h*) is seen overlapping a portion of the proximal part of the petasma, and it has a rounded angle. The well chitinized part (*ch.*) of the terminal portion is rather curved with a large number of

small, sharp tubercles on much of the inner side and especially on the major distal part of its convex margin (figs. 2*h* and 2*i*); before the end this chitinized part is somewhat narrow, and the end itself is obliquely and distinctly expanded. The processus ventralis is somewhat flattened, narrower at the base and broader towards the end which is somewhat incised and adorned with a consequently bipartite brush of numerous short chitinous threads. The brush is frequently easy to see without preparation, and the brush together with the distinctly widened plate-shaped end of the sheath are excellent specific characters. — The protuberance (fig. 2*g*, *p*.) on the front margin of the pleopod is oblong as in the preceding forms.

Length of a male 9.5 mm., of a female 10.8 mm.

Remarks. — The male can always be determined with certainty. Most frequently the shape of the end of the uropods is sufficient, but in some specimens this end is not very different from the shape sometimes found in *L. intermedius* or, rarely, *L. Hanseni*, and in such cases an inspection of the shape of the petasma will instantly decide the question. But in some cases I have found it impossible to decide whether a female belonged to *L. penicillifer*.

Distribution. — *L. penicillifer* is extremely common in the "Siboga" area, as it has been taken at more than forty stations, in reality in the majority of the Plankton samples containing specimens of the genus. And at a number of stations from a hundred to a thousand specimens were taken, probably in the same haul. The Copenhagen Museum possesses specimens from the Bay of Bengal ("Galathea" Exped.); at lat. 4° 20′ N., long. 107° 20′ E. (Capt. ANDRÉA); lat. 15° 14′ N., long. 118° E. ("Galathea"); Formosa Strait ("Galathea"); Manilla ("Galathea"); Chinese Sea, Hongkong—Shanghai ("Galathea"), and Gulf of Yeddo ("Galathea").

5. *Lucifer Faxonii* Borrad. Pl. V, figs. 3*a*—3*i*.

1878. *Lucifer typus*? Faxon, Stud. Biol. Lab. Johns Hopkins Univ. 3, p. 113, Pl. VII, [teste BORRADAILE].
1882. *Lucifer sp.* Brooks, Phil. Trans. Roy. Soc. London, Vol. 173, I, p. 87, Pls. 7—9, figs. 61—75.
1915. *Lucifer faxoni* Borradaile, Ann. Mag. Nat. Hist. Ser. 8, Vol. XVI, p. 228.

Stat. 66. May 7—8. Bank between Bahuluwang and Tambolungan, South of Saleyer. 8—10 m. Plankton. 12 specimens.
Stat. 98—99. June 28—30. Lat. 6° 9′—6° 7′.5 N., long. 120° 21′—120° 26′ E. Townet. 14 specimens.
Stat. 117a. July 12. Lat. 1° 15′ N., long. 123° 37′ E. Townet. 2 specimens.
Stat. 125. July 18—19. Anchorage off Sawan, Siau-island. 27 m. 4 specimens.
Stat. 136. July 29—Aug. 3. Ternate anchorage. 23 m. Townet. 1 specimen.
Stat. 138. Aug. 3. Anchorage on the east coast of Kajoa-island. 66 m. Townet. Large number of specimens.
Stat. 140. Aug. 4—5. Bay of Batjan. 13 m. Townet. 2 specimens.
Stat. 144. Aug. 7—9. Anchorage North of Salomakiëe-(Damar-)island. 45 m. Townet. 11 specimens.
Stat. 177a. Sept. 1. Lat. 2° 30′ S., long. 129° 28′ E. Townet. 15 specimens.
Stat. 184. Sept. 11—12. Anchorage off Kampong Kelang, South coast of Manipa-island. 36 m. Townet. 8 specimens.
Stat. 185. Sept. 12. Lat. 3° 20′ S., long. 127° 22′.9 E. HENSEN vertical net, from 1536 m. depth to surface. 1 specimen.
Stat. 189a. Sept. 12. Lat. 2° 22′ S., long. 126° 46′ E. Townet. 2 specimens.

Stat. 194. Sept. 15. Lat. 1° 53′.5 S., long. 126° 39′ E. Townet. 21 specimens.
Stat. 194—197. Sept. 15. Lat. 1° 53′.5—1° 45′.3 S., long. 126° 39′—127° 8′.3 E. Plankton. 5 specimens.
Stat. 203. Sept 19. Lat. 3° 32′.5 S., long. 124° 15′.5 E. HENSEN vertical net, from 1500 m. to surface. 8 specimens.
Stat. 206. Sept. 21. Buton-strait. Surface. 1 specimen.
Stat. 216. Oct. 30. Lat. 6° 49′ S., long. 122° 43′ E. 2190 m. FOWLER closing net, from 975 to 415 m. depth. 4 specimens.
Stat. 220. Nov. 1—3. Anchorage off Pasir Pandjang, west coast of Binongka. 278 m. Townet. 5 specimens.
Stat. 230. Nov. 14. Lat. 3° 58′ S., long. 128° 20′ E. HENSEN vertical net, from 2000 m. depth to surface. 1 specimen.
Stat. 245. Dec. 3. Lat. 4° 16′.5 S., long. 130° 15′.8 E. Townet. 12 specimens.
Near Stat. 300. Between Timor and Lomblen. Plankton. 3 specimens.

Description. — Eye-stalks with eyes shorter in proportion to the body than in *L. intermedius* and conspicuously less than half as long as the distance between their insertion and the labrum; the stalks increase gradually and considerably in thickness from the base to the eye. First antennular joint in the male reaches somewhat beyond the front margin of the eyes (fig. 3*a*); in the females this joint is frequently proportionately still longer, and in such cases it reaches very considerably beyond the eyes. In the male the two ventral processes on sixth abdominal segment (fig. 3*b*) are shaped nearly as in *L. intermedius*, but the anterior process is placed more backwards, consequently considerably more distant from the base of the segment than from the second process. Exopod of uropods in the male (fig. 3*b*) about five times as long as broad; its terminal margin is slightly or rather considerably oblique (figs. 3*c* and 3*d*), and the marginal process, which varies much in size, reaches always in the "Siboga" specimens to or, generally, beyond the upper distal angle of the exopod (as to the Atlantic specimens see "Remarks"). In the female the exopod is almost as narrow as in the male, but the terminal margin is always rather oblique, and the marginal process which is long (fig. 3*e*) or short, does not always reach so far backwards as the upper distal angle.

The petasma (figs. 3*g*—3*i*) differs much from those in the preceding forms, but is rather similar to that in *L. Hanseni*. Its terminal portion tapers gradually from the base to the acute end; it is considerably curved, and a short part near the end is curved distinctly in the opposite direction. Processus ventralis (*pv.* in figs. 3*h* and 3*i*) is shaped nearly as a needle, tapering to the very acute end. The protuberance (*p.* in figs. 3*g* and 3*h*) on the front margin of the pleopod is as long as, or longer than, broad at the base, with some or several prickles on the end.

Length of a male 11 mm., of a female 11.5 mm.

Remarks. — *L. Faxonii* is in general aspect somewhat similar to *L. intermedius*, but the males of both species differ generally distinctly from *L. penicillifer* in the shape of the exopod of the uropods. Both sexes of *L. Faxonii* differ from the two species mentioned in the length of the first antennular joint in proportion to the eyes, and this feature affords a fine specific character. From Cruz Bay, St. Jan, West Indies, the Copenhagen Museum possesses a large material; the males differ most frequently from the "Siboga" specimens in having the upper distal angle of the exopod of the uropods reaching to or beyond the end of the marginal tooth, but in a few specimens the tooth reaches beyond that margin as in most "Siboga" specimens.

As no other species with short eye-stalks is known from the whole Atlantic, the name *L. Faxonii* given by BORRADAILE to the form figured by FAXON and BROOKS and captured north of the line in that Ocean can be applied with certainty.

Distribution. — The list of localities and number of specimens show that *L. Faxonii* is moderately common in the major part of the "Siboga" area. The Copenhagen Museum possesses specimens from some places in the Atlantic: lat. 33° N., long. 47° W. ("Galathea" Exped.); Cruz Bay, St. Jan, West Indies (Dr. TH. MORTENSEN); off Puerto Cabello (Commodore H. KIÆR); lat. 4° 30′ N., long. 28° 20′ W. (HUGO MÜLLER); lat. 23° S., long. 42° W. (JONAS BELDRING). — The specimens from the Atlantic taken by the German Plankton-Expedition and referred by ORTMANN to *L. typus* belong certainly to the present species; on its occurrence ORTMANN wrote (op. cit. 1893, p. 41), that in contradistinction to the other species (dealt with by me above as the real *L. typus* H. M.-Edw.) it is "sehr lokalisiert: ausser je einem, offenbar versprengten Exemplar im Floridastrom und der Sargasso-See (nahe Bermuda) fand er sich zahlreich an einer bestimmten Stelle des südlichen Aequatorialstroms (nahe Fernando Noronha) und massenhaft auf der Küstenbank vor der Tocantins-Mündung".

6. *Lucifer Hanseni* Nobili. Pl. V, figs. 4*a*—4*o*.

1905. *Lucifer Hanseni* Nobili, Bull. Mus. d'Hist. Natur. 1905, n° 6, p. 394.
1906. *Lucifer Hanseni* Nobili, Ann. Sci. Natur., Zool. 9. ser., T. IV, p. 25 (with fig. 3), Pl. II, fig. 1.
1915. *Lucifer inermis* Borradaile, Ann. Mag. Nat. Hist. ser. 8, Vol. XVI, p. 229.
1916. *Lucifer hanseni* Borradaile, Brit. Antarct. Exped., Crust. I, Decapoda, p. 83.

Stat. 7. March 11. Lat. 7° 55′.5 S., long. 114° 26′ E. 15 m. and more. 1 specimen.
Stat. 16. March 15—16. Bay of Kankamaräan, S. coast of Kangeang. 22 m. Electric light in vertical net. 1 specimen.
(Stat. 26—32). March 23. Lat. 8° 35′.1—9° 2′ S., long. 115° 31′.2—115° 47′ E. Surface. 1 specimen.
Stat. 35. March 28. Lat. 8° 0′.3 S., long. 116° 59′ E. Surface. 6 specimens.
Stat. 37. March 30—31. Sailus ketjil, Paternoster-islands. 27 m. and less. 4 specimens.
Stat. 50. April 16—18. Bay of Badjo, West coast of Flores. Depth up to 40 m. Plankton. 3 specimens.
Stat. 66. May 7—8. Bank between Bahuluwang and Tambolungan, South of Saleyer. 8—10 m. Plankton. Numerous specimens.
Stat. 71. May 10—June 7. Makassar and surroundings. Depth up to 32 m. Townet. About 25 specimens. (Most of the specimens small with black eyes).
Stat. 98—99. June 28—30. Lat. 6° 9′—6° 7′.5 N., long. 120° 21′—120° 26′ E. Townet. 2 specimens.
Stat. 99. June 28—30. Lat. 6° 7′.5 N., long. 120° 26′ E. 16—23 m. Townet. Numerous specimens.
Stat. 104. July 2—3. Sulu harbour, Sulu-island. 14 m. Townet. 4 specimens.
Stat. 105. July 4. Lat. 6° 8′ N., long. 121° 19′ E. 275 m. Plankton. 2 specimens.
Stat. 106. July 4. Anchorage off Kapul-island, Sulu-archipelago. Townet. Large number of specimens.
Stat. 109. July 5—6. Anchorage off Pulu Tongkil, Sulu-archipelago. 13 m. Townet. Many specimens.
Stat. 128. July 22. Lat. 4° 27′ N., long. 125° 25′.7 E. 1645 m. HENSEN vertical net, from 700 m. to surface. 1 specimen.
Stat. 136. July 29—Aug. 3. Ternate anchorage. 23 m. Townet. Many specimens.
Stat. 138. Aug. 3. Anchorage on the East coast of Kajoa-island. 66 m. Townet. 2 specimens.
Stat. 141. Aug. 5. Lat. 1° 0′.4 S., long. 127° 25′.3 E. 1950 m. HENSEN vertical net, from 1500 m. to surface. Many specimens.

Stat. 142. Aug. 5—7. Anchorage off Laiwui, coast of Obi Major. 23 m. Electric light in vertical net. Very large number of specimens. (The specimens with black eyes).
Stat. 143. Aug. 7. Lat. 1° 4′.5 S., long. 127° 52′.6 E. 1454 m. HENSEN vertical net, from 1000 m. to surface. 2 specimens.
Stat. 144. Aug. 7—9. Anchorage North of Salomakiëe-(Damar-)island. Townet. Numerous specimens.
Stat. 146. Aug. 9. Lat. 0° 36′ S., long. 128° 32′.7 E. 512 m. Townet. 2 specimens.
Stat. 157. Aug. 15—16. Lat. 0° 32′.9 S., long. 130° 14′.6 E. 45 m. Townet: 10 specimens.
Stat. 165. Aug. 20—22. Anchorage on North-east side of Daram-island, East coast of Misool. 49 m. Townet. 2 specimens.
Stat. 168. Aug. 22—23. Anchorage North of Sabuda-island. 63 m. Townet. 1 specimen.
Stat. 174. Aug. 28—29. Waru-bay, North coast of Ceram. 18 m. 2 specimens.
Stat. 177a. Sept. 1. Lat. 2° 30′ S., long. 129° 28′ E. Townet. Many specimens.
Stat. 184. Sept. 11—12. Anchorage off Kampong Kelang, South coast of Manipa-island. 36 m. Townet. 3 specimens.
Stat. 185. Sept. 12. Lat. 3° 20′ S., long. 127° 22′.9 E. Manipa-strait. HENSEN vertical net, from 1536 m. to surface. 4 specimens.
Stat. 189a. Sept. 12. Lat. 2° 22′ S., long. 126° 46′ E. Townet. 15 specimens.
Stat. 194. Sept. 15. Lat. 1° 53′.5 S., long. 126° 39′ E. 1504 m. Townet. 17 specimens.
Stat. 194—197. Sept. 15. Lat. 1° 53′.5—1° 45′.3 S., long. 126° 39′—127° 8′.3 E. Plankton. 2 specimens.
Stat. 203. Sept. 19. Lat. 3° 32′.5 S., long. 124° 15′.5 E. HENSEN vertical net, from 1500 m. to surface. 8 specimens.
Stat. 206. Sept. 21. Buton-strait. Surface. 2 specimens.
Stat. 216. Oct. 30. Lat. 6° 49′ S., long. 122° 43′ E. 2190 m. FOWLER closing net, from 975 to 415 m. depth. 2 specimens.
Stat. 220. Nov. 1—3. Anchorage off Pasir Pandjang, West coast of Binongka. 278 m. Townet. 1 specimen.
Stat. 223. Nov. 6. Lat. 5° 44′.7 S., long. 126° 27′.3 E. 4391 m. Surface. 1 specimen.
Stat. 225. Nov. 8. 5700 M. N. 279° E. from Southpoint of South-Lucipara-islands. 894 m. Horizontal cylinder. 30 specimens.
Stat. 245. Dec. 3. Lat. 4° 16′.5 S., long. 130° 15′.8 E. 4956 m. Townet. 7 specimens.
Stat. 276. Jan. 9. Lat. 6° 47′.5 S., long. 128° 40′.5 E. HENSEN vertical net, from 750 m. to surface. 2 specimens.
Near Stat. 300. Between Timor and Lomblen. Plankton. 3 specimens.
Stat. 315. Febr. 17—18. Anchorage East of Sailus Besar, Paternoster-islands. Surface. 1 specimen.

Description. — This species shows some variation in various particulars. Eye-stalks with eyes vary from a little more to conspicuously less than half as long as the distance between their insertion and the labrum (fig. 4 *a*); the stalks nearly as in *L. penicillifer*, as sometimes they are conspicuously inverted conical, and sometimes increasing feebly in thickness to near or beyond the middle. First antennular joint in both sexes either reaches a little beyond the eyes or, and perhaps most frequently, it is proportionately shorter, reaching to (fig. 4 *a*) or not fully to the front margin of the eyes. Sixth abdominal segment in the male somewhat (fig. 4 *b*) or, most frequently, much deeper (fig. 4 *k*) in proportion to its length than in the preceding forms; the first ventral process is much shorter than the second, and sometimes quite small (fig. 4 *k*); besides it is always distinctly nearer to the second process than to the base of the segment, and in most males the distance between the median point in the base of the two processes is about half, or even only one-third, as long as the distance from the base of the segment to the first process; second process tapers always to the obtuse end, but it varies

considerably in thickness. In the female the sixth segment is also proportionately deeper than in the other species. That the telson varies in shape is shown in figs. 4*h* and 4*i*, representing that appendice in two males from the same station. In the male the exopod of the uropods is observed in specimens from the same locality to vary from being four and a half times as long as broad, but generally it is only slightly or somewhat more than four times as long as broad; the upper distal angle of the exopod reaches always beyond the end of the marginal tooth which is small, and excepting in a few small specimens (fig. 4*f*) this tooth is placed much (fig. 4*c*) or very much (fig. 4*d*) in advance of the upper distal angle. In the female the exopod is about four times as long as broad, and the marginal tooth is placed far before its end (figs. 4*e* and 4*g*).

The petasma (figs. 4*l*—4*o*) is rather similar to that in *L. Faxonii*. Its terminal portion is proportionately shorter; its acute or subacute end less produced and it is not curved in the opposite direction towards the end. The processus ventralis (*pv.* in figs. 4*n* and 4*o*) has its distal half shaped as a curved, acute needle differing somewhat in shape from that in *L. Faxonii*. The protuberance on the front margin of the pleopod generally short (*p.* in figs. 4*l* and 4*m*) and very broad in proportion to its length, with several or many prickles.

Length of a male 9 mm., of a large female 11.6 mm.

Remarks. — Nobili's figures and his footnote on p. 27 (l. c.) are sufficient for recognizing the species with certainty. As already pointed out in the description, it shows not inconsiderable individual variation, and one curious point is not mentioned above. In the specimens from nearly all the "Siboga" stations the eyes are light opaque or brownish, but in the hundreds of specimens from Stat 142 the eyes are internally partly or totally black, and the same colour is also found in some specimens from Stat. 71, in numerous specimens from Colombo gathered in 1898 and even in some specimens secured by the "Galathea" Expedition more than seventy years ago. One is tempted to think that the difference in the colour of the eyes might be a specific character, but in spite of a good deal of trouble I have been unable to find any other character, not even in the petasma, and the variation found in other features was independent of the colour of the eyes.

Distribution. — The long list of localities shows that *L. Hanseni* has been taken at almost as many places in the "Siboga" area as *L. penicillifer*, but the number of specimens of *L. Hanseni* is, taken as a whole, very much lower, probably not one-third as large as of *L. penicillifer*. Nobili established *L. Hanseni* on specimens taken at Djibouti (the Red Sea), and Borradaile records numerous specimens gathered in Melbourne harbour. The Copenhagen Museum possesses specimens from Colombo, Ceylon (Mr. H. Mortensen); the Bay of Bengal ("Galathea" Exp.); Lower India, and the Chinese Sea ("Galathea"). Consequently it has a very wide distribution in the Indian Ocean and in at least a considerable part of the Pacific.

EXPLANATION OF THE PLATES.

PLATE I.

In all figures representing the male petasma or the distal half of its pars media the following lettering is used. *a.* pars astringens; *e.* pars externa; *lam.* lamina externa of pars externa; *pu.* processus uncifer of pars externa; *m.* pars media; *pb.* processus basalis; *pv.* processus ventralis; *la.* lobus armatus; *lc.* lobus connectens; *li.* lobus inermis; *lt.* lobus terminalis; *lac.* lobi accessorii.

Fig. 1. *Sergestes inous* Faxon.

Fig. 1*a*. Left petasma, from behind; × 7.
Fig. 1*b*. Distal portion of pars media of the same petasma, from behind; × 19.
Fig. 1*c*. Distal portion of pars media of the same petasma, from in front; × 19.

Fig. 2. *Sergestes Gardineri* Kemp.

Fig. 2*a*. Left petasma, from behind; × 20.
Fig. 2*b*. Distal portion of pars media of the same petasma, from behind; × 40.
Fig. 2*c*. Distal portion of pars media of the same petasma, from in front; × 40.

Fig. 3. *Sergestes bisulcatus* Wood-Mason.

Fig. 3*a*. Front end of the carapace of a female, from the left side; × 6.
Fig. 3*b*. Left petasma, from behind; × 13.
Fig. 3*c*. Distal portion of pars media of the same petasma, from behind; × 30.
Fig. 3*d*. Distal portion of pars media of the same petasma, from in front; × 30.

Fig. 4. *Sergestes Challengeri* H. J. H.

Fig. 4*a*. Front end of the carapace of a female, from the left side; × 13.
Fig. 4*b*. Right eye-stalk with eye of a female from Stat. 46ª, from above; × $^{23}/_{2}$.
Fig. 4*c*. Third joint of left antennular peduncle with the proximal parts of the two flagella of a male from Stat. 185, from the left side; × 15.
Fig. 4*d*. Third joint of left antennular peduncle of another male from Stat. 185, from the left side; × $^{21}/_{2}$.
Fig. 4*e*. Third joint of left antennular peduncle of a female, from the left side; × $^{29}/_{2}$.
Fig. 4*f*. Distal portion of pars media of left petasma of a male from Stat. 185, from behind; × 32.
Fig. 4*g*. Same distal portion of pars media of left petasma, from in front; × 32.
Fig. 4*h*. Distal half of processus uncifer of the same petasma, from behind; × 32.
Fig. 4*i*. Anterior part of a very young specimen, 13.3 long, from Stat. 143, from above; × 13.
Fig. 4*k*. Exopod of left uropod of a *Mastigopus*, 12.3 mm. long, from the outer side; × 14.
Fig. 4*l*. Anterior part of a *Mastigopus*, 12.3 mm. long, from Stat. 148, from the left side; × 13. *a.* rostrum; × 32.

Fig. 5. *Sergestes sp.*

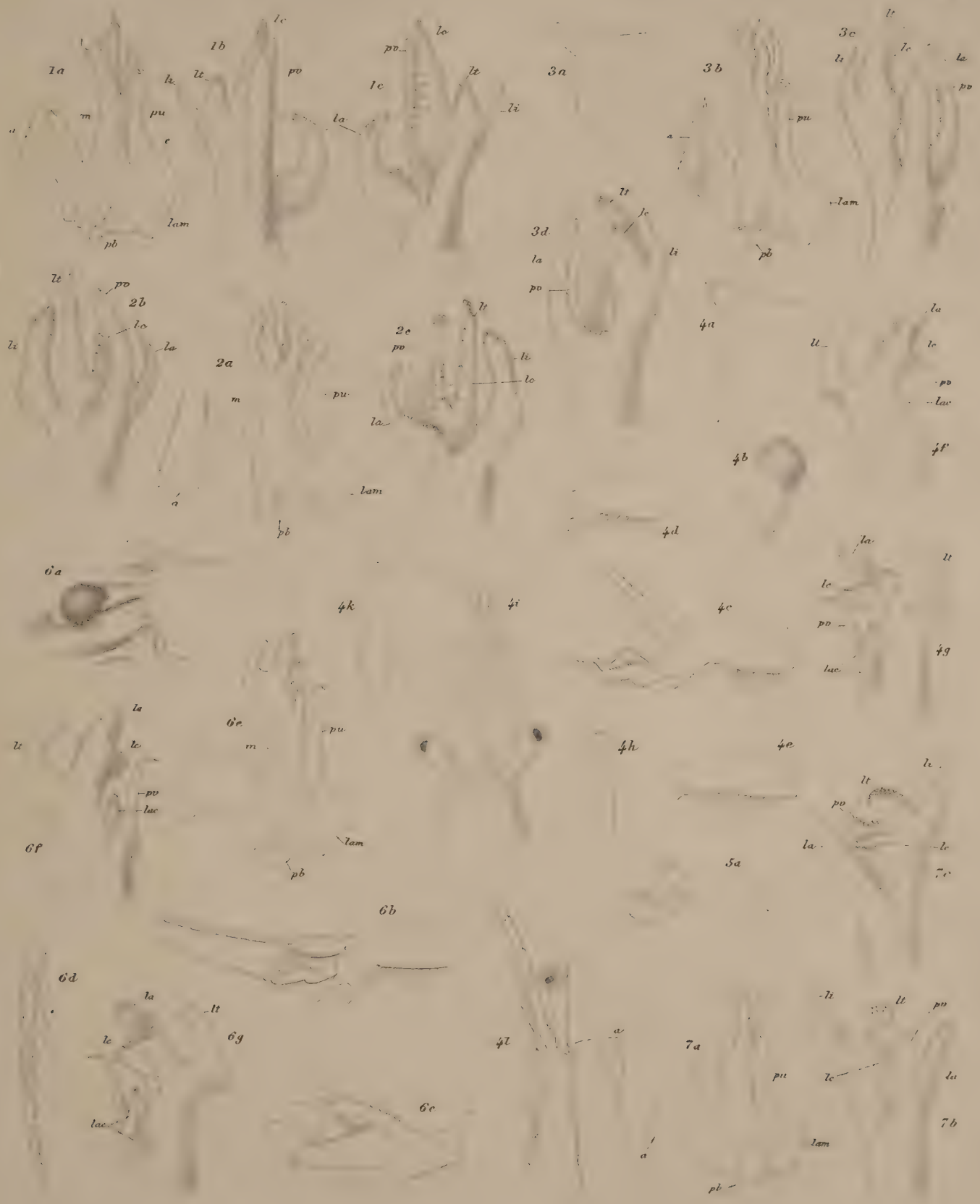
Fig. 5*a*. Third joint of left antennular peduncle with the proximal parts of both flagella of an adult male from Stat. 100, from the outer side; × 9.

Fig. 6. *Sergestes fulgens* n. sp.

Fig. 6*a*. Anterior part of the carapace with left eye and the basal parts of antennula and squama of a male, from the left side; × 6.
Fig. 6*b*. Third joint of left antennular peduncle with the lower flagellum and the proximal part of the upper flagellum of an adult male, from the left side; × 9.
Fig. 6*c*. Proximal half (the clasping organ) of the lower flagellum of the same antennula, from the outer side; × 24.
Fig. 6*d*. Distal part of third maxilliped of a male; × 14. The terminal setæ wanting.
Fig. 6*e*. Left petasma, from behind; × 12.
Fig. 6*f*. Distal portion of pars media of the same petasma, from behind; × 22.
Fig. 6*g*. Same distal portion of pars media of left petasma, from in front; × 22.

Fig. 7. *Sergestes seminudus* n. sp.

Fig. 7*a*. Left petasma, from behind; × 16.
Fig. 7*b*. Distal half of pars media of the same petasma, from behind; × 31.
Fig. 7*c*. Distal half of the same pars media of left petasma, from in front; × 31.



1. Sergestes inous Faxon. 2 S. Gardineri Kemp. 3. S. bisulcatus Wood-Mason. 4. S. Challengeri H.J.H.

5. Sergestes sp., ♂ 6. S. fulgens n.sp. 7. S. seminudus n.sp.

H.J. Hansen del. *P.N. Möller sc.*

PLATE II.

Fig. 1. *Sergestes seminudus* n. sp. (Continued).

Fig. 1*a*. Sixth joint and distal part of fifth joint of third maxilliped; × 12.

Fig. 1*b*. Distal part of first thoracic leg; × 12.

Fig. 1*c*. Carapace, anterior appendages and the two anterior abdominal segments of an *Acanthosoma*, from above; × scarcely 16. The four processes on right half of the carapace and the distal part of the antennæ omitted. *a.*[1] antennula; *a.*[2] antenna; *sq.* squama.

Fig. 1*d*. Carapace, left eye and proximal parts of left antennula and antenna of another *Acanthosoma*, from the left side; × 34. *sq.* squama.

Fig. 1*e*. Dorsal part of the five anterior abdominal segments of an *Acanthosoma*, from the left side; × 30.

Fig. 1*f*. Terminal part of sixth abdominal segment, telson and left uropod of an *Acanthosoma*, from above; × 35.

Fig. 2. *Sergestes orientalis* n. sp.

Fig. 2*a*. Front end of the carapace of a male, from the left side; × 14.

Fig. 2*b*. Lower flagellum of right antennula of a male, from the outer side; × 35.

Fig. 2*c*. Left third maxilliped — the basal joint omitted — of a male, from the outer side; × 9. *a.* the six subjoints of sixth joint and the end of fifth joint; × 20.

Fig. 2*d*. First left thoracic leg of the same male, from the outer side; × 9.

Fig. 2*e*. Distal part of the same first thoracic leg, from the outer side; × 34.

Fig. 2*f*. Fourth left thoracic leg of the same male, from the outer side; × 9.

Fig. 2*g*. Left petasma, from behind; × 30. *a.* pars astringens; *lam.* lamina externa, and *pu.* processus uncifer, both portions of pars externa; *pb.* processus basalis.

Fig. 2*h*. Distal portion of pars media of the same petasma, from behind; × 48. *la.* lobus armatus, bifurcate; *lc.* lobus connectens; *li.* lobus inermis; *lt.* lobus terminalis; *lac.* lobus accessorius; *pv.* processus ventralis.

Fig. 2*i*. Same distal portion of pars media of left petasma, from in front; × 48. The lettering as in fig. 2*h*.

Fig. 2*k*. Distal portion of pars media of left petasma of a male from lat. 19° 14′ N., long. 116° 6′ E., from behind; × 47. The lettering as in fig. 2*h*.

Fig. 2*l*. Carapace with eyes, major part of the antennulæ, and antennal squamæ of a *Mastigopus*, 4.3 mm. long, from above; × 16.

Fig. 2*m*. Distal part of left third maxilliped of a *Mastigopus*, 10.8 mm. long, from the outer side, × 22.

Fig. 2*n*. Sixth abdominal segment with telson and left uropod of a young *Mastigopus* measuring 3.3 mm., from the left side; × 23. Setæ on the upper margin of the exopod omitted.

Fig. 2*o*. Carapace with eyes, antennulæ, antennal squamæ and first abdominal segment of an *Acanthosoma*, from above; × 20. *a.*[1] antennula; *sq.* squama.

Fig. 2*p*. Carapace with left eye, antennula, antennal squama and proximal part of antennal flagellum of another *Acanthosoma*, from the left side; × 20.

Fig. 2*q*. Posterior part of sixth abdominal segment with telson and left uropod of the *Acanthosoma* shown in fig. 2*o*, from above; × 32.

Fig. 3. *Sergestes Edwardsii* Kr.

Fig. 3*a*. Distal portion of pars media of left petasma of a specimen from the Atlantic at lat. 3° 9′ N., long. 23° 11′ W., from behind; × 47. The lettering as in fig. 2*h*.

Fig. 4. *Sicyonella maldivensis* Borradaile.

Fig. 4*a*. Anterior right part of carapace with eye, antennula and antennal squama of a male from Stat. 164, from above; × 9.

Fig. 4*b*. Anterior right part of carapace with eye, antennula and antennal squama of a female from Stat. 164, from above; × 9.

Fig. 4*c*. Terminal part of right antennular peduncle with the proximal parts of both flagella of a male, from the inner side; × 24.

Fig. 4*d*. Distal joints of first thoracic leg of a female, from below; × 22.

Fig. 4*e*. Left petasma, from behind; × 21. *a.* pars astringens; *lam.* lamina externa, and *pu.* processus uncifer, of pars externa.

Fig. 4*f*. Distal half of pars media of the same petasma, from behind; × 42. *la.* lobus armatus; *lc.* lobus connectens; *lt.* lobus terminalis; *pv.* processus ventralis, ramified (see text).

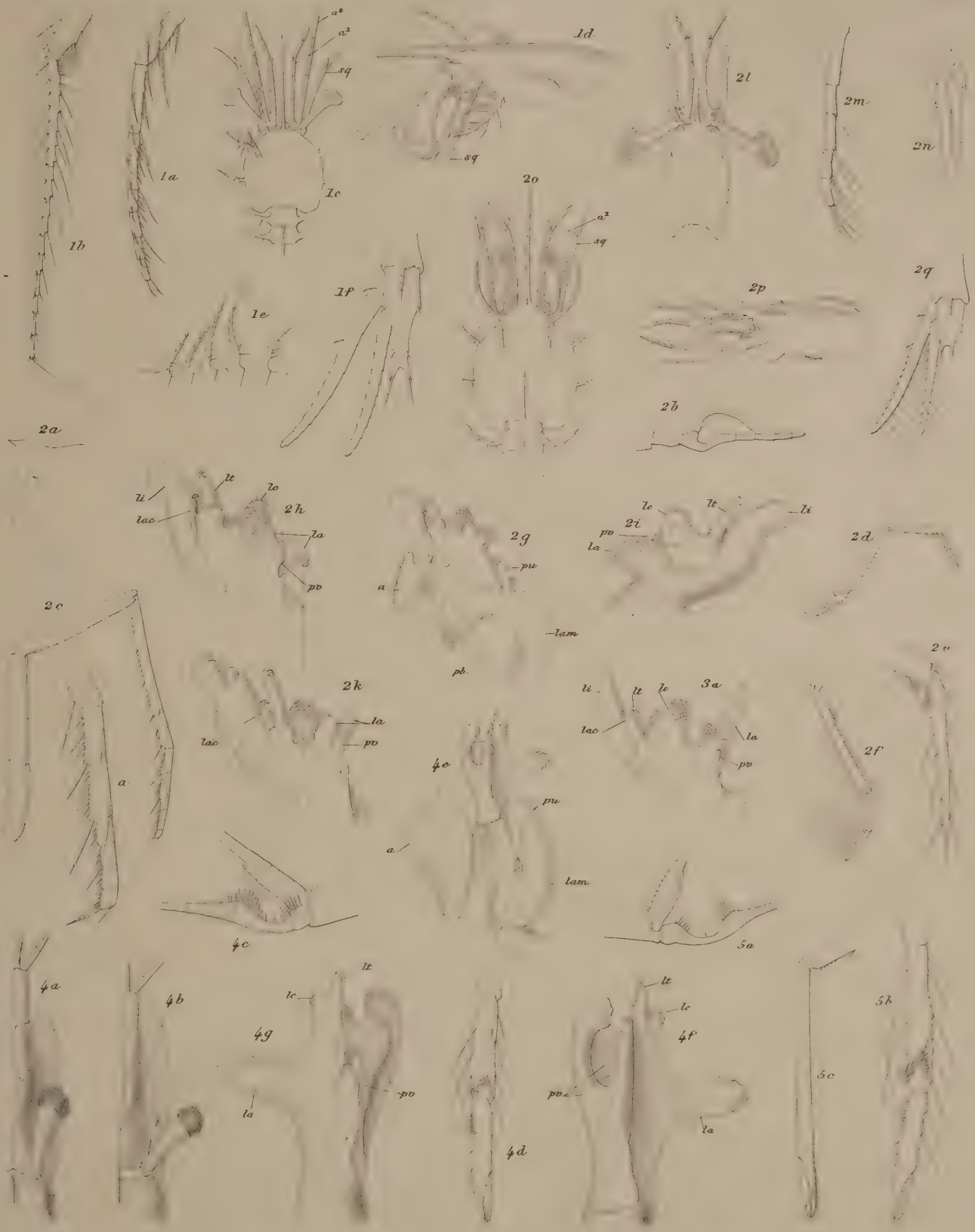
Fig. 4*g*. Same distal portion of pars media of the petasma, from in front; × 42. The lettering as in fig. 4*f*.

Fig. 5. *Sicyonella antennata* n. sp.

Fig. 5*a*. Terminal part of right antennular peduncle with the proximal parts of both flagella of a male, from the outer side; × 21.

Fig. 5*b*. Distal joints of first thoracic leg of a female, from below; × 20.

Fig. 5*c*. Distal part of third thoracic leg of the same female; × 20.



1. Sergestes seminudus n. sp. *2. S. orientalis n. sp.* *3. S. Edwardsii Kr.*

H.J. Hansen del. *4. Sicyonella maldivensis Borrad.* *5. Sic. antennata n. sp.* T.N. Möller sc.

PLATE III.

Fig. 1. *Sicyonella antennata* n. sp. (Continued).

Fig. 1*a*. Anterior part of an adult male, from above; × 7.

Fig. 1*b*. Anterior right part of carapace with eye, antennula and squama of an adult female, from Stat. 258, from above; × 9.

Fig. 1*c*. Exopod of left uropod of a male; × scarcely 7.

Fig. 1*d*. Left petasma, from behind; × 20. *a*. pars astringens; *lam*. lamina externa, and *pu*. processus uncifer, of pars externa.

Fig. 1*e*. Distal half of pars media of the same petasma, from behind; × 38. *la*. lobus armatus; *lc*. lobus connectens; ? *li*, probably lobus inermis; *lt*. lobus terminalis; *lac*. lobus accessorius; *pv*. processus ventralis, cleft into two main branches.

Fig. 1*f*. Same distal half of pars media of the petasma, from in front; × 38. The lettering as in fig. 1*e*.

Fig. 2. *Acetes vulgaris* n. sp.

Fig. 2*a*. Anterior part of a male, from above; × $^{13}/_{2}$.

Fig. 2*b*. Anterior right part of carapace with eye, antennula and squama of an adult female from the Gulf of Siam, from above; × $^{13}/_{2}$.

Fig. 2*c*. Front end of the carapace of a female, from the left side; × 17.

Fig. 2*d*. Proximal part of left lower antennular flagellum of a male, from the outer side; × 33.

Fig. 2*e*. Left mandible of a male, from below; × 14.

Fig. 2*f*. Left maxillula of the same male, from below; × 14.

Fig. 2*g*. Left maxilla of the same male, from below; × 14. *p*. palp.

Fig. 2*h*. Left first maxilliped of the same male, from below; × 14. *ep*. epipod; *ex*. exopod.

Fig. 2*i*. Left second maxilliped of the same male, from behind; × 14. *br*. branchia; *ep*. epipod.

Fig. 2*k*. Distal part of left third maxilliped of the same male; × 23.

Fig. 2*l*. Distal part of left first thoracic leg of the same male; × 23.

Fig. 2*m*. Left uropod of a male, from the outer side; × 7.

Fig. 2*n*. Posterior part of thorax of a male, from below; × 11. *l*.^{3} third thoracic leg; *gc*. genital coxæ.

Fig. 2*o*. Posterior part of thorax of a female, from below; × 11. *s*.^{4} fourth (penultimate) thoracic segment; *s*.^{5} fifth (last) thoracic segment.

Fig. 2*p*. Left petasma, from behind; × 22. *a*. pars astringens; *e*. pars externa.

Fig. 2*q*. Distal portion of pars media of the same petasma, from behind; × 51. *c*. capitulum; *pv*. processus ventralis.

Fig. 2*r*. Distal portion of pars media of the same petasma, from in front; × 51. *c*. capitulum; *pv*. processus ventralis.

Fig. 3. *Acetes sp.*

Fig. 3*a*. Distal portion of pars media of left petasma of a male from Stat. 47, from in front; × 44.

Fig. 4. *Acetes Sibogæ* n. sp.

Fig. 4*a*. Anterior part of the carapace with right eye, antennula and squama of a male, from above; × 9.

Fig. 4*b*. End of third peduncular joint of left antennula with lower flagellum and the proximal part of upper flagellum of a male, from the outer side; × 38.

Fig. 4*c*. Exopod of left uropod of a male; × 11.

Fig. 4*d*. Posterior part of thorax of a male, from below; × 13.

Fig. 4*e*. Posterior part of thorax of a female, from below; × 13.

Fig. 4*f*. Left petasma, from behind; × 28.

Fig. 4*g*. Distal half of pars media of the same petasma, from behind; × 46. *c*. capitulum; *pv*. processus ventralis.

Fig. 4*h*. Same distal half of pars media of the petasma, from in front; × 46. The lettering as in fig. 4*g*.

Fig. 5. *Acetes dispar* n. sp.

Fig. 5*a*. Anterior part of the carapace with right eye, antennula and squama of a male from Cheribon (Java), from above; × 11.

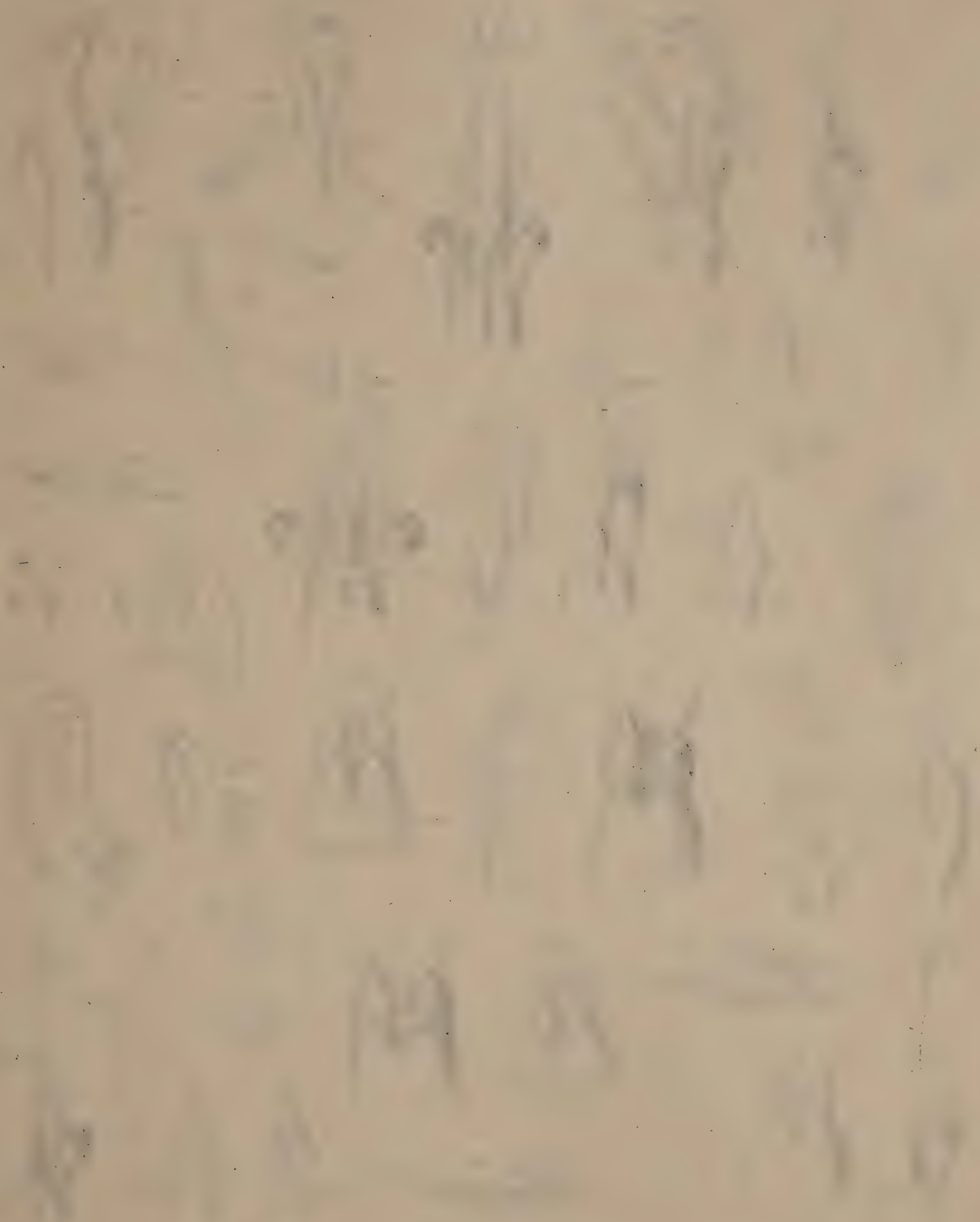
Fig. 5*b*. End of third peduncular joint of left antennula with the lower flagellum and the proximal part of upper flagellum of a male from Siam, from the outer side; × 39.

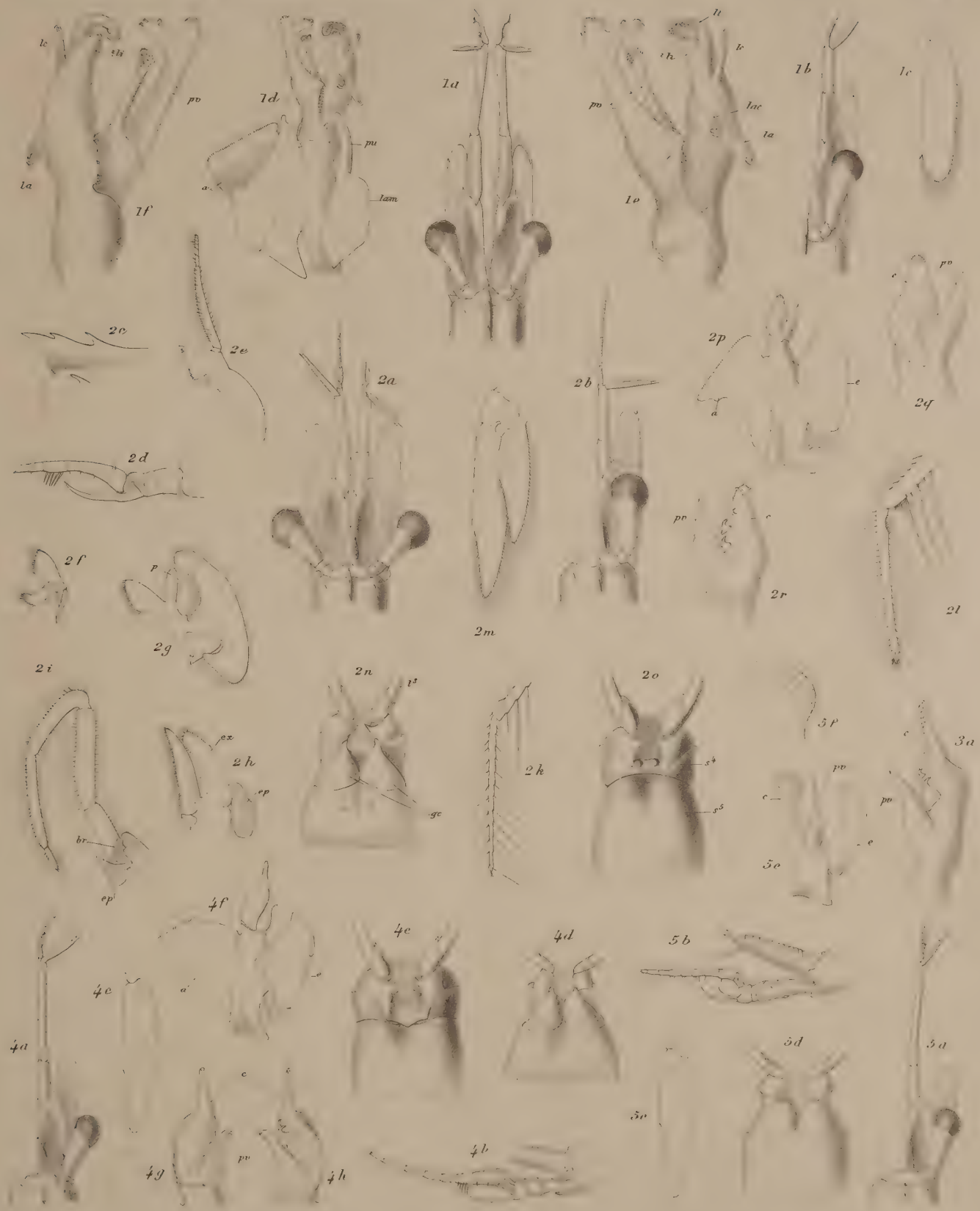
Fig. 5*c*. Exopod of left uropod of a male; × 14.

Fig. 5*d*. Posterior part of thorax of a male, from below; × $^{35}/_{2}$.

Fig. 5*e*. Left petasma, from behind; × 32. *c*. capitulum; *e*. pars externa; *pv*. processus ventralis.

Fig. 5*f*. Distal portion of pars media of the same petasma, from behind; × 66.





1. Sicyonella antennata n. sp. 2. Acetes vulgaris n. sp. 3. Acetes sp. 4. A. Sibogæ n. sp.
5. A. dispar n. sp.

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PLATE IV.

Fig. 1. *Acetes dispar* n. sp. (Continued).

Fig. 1*a*. Posterior part of thorax of a female, from below; × 21.

Fig. 2. *Acetes dispar* var. vel sp. n.

Fig. 2*a*. Posterior part of thorax of a female from lat. 24° 17′ N., long. 118° 15′ E., from below; × 13.

Fig. 3. *Acetes chinensis* n. sp.

Fig. 3*a*. Exopod of left uropod of a female; × 7.

Fig. 3*b*. Posterior part of thorax of a female, from below; × 13.

Fig. 4. *Acetes serrulatus* Kröyer.

Fig. 4*a*. Anterior part of the carapace with the right eye, antennula and antenna of a male, from above; × 9.

Fig. 4*b*. Front end of the carapace of a female, from the left side; × 29.

Fig. 4*c*. End of third peduncular joint of left antennula with lower flagellum and the proximal part of upper flagellum of a male, from the left side; × 39.

Fig. 4*d*. Exopod of left uropod of a male; × 11.

Fig. 4*e*. Posterior part of thorax of a male, from below; × $^{27}/_{2}$. *gc*. genital coxæ.

Fig. 4*f*. Posterior part of thorax of a female, from below; × 15.

Fig. 4*g*. Left petasma, from behind; × 33. *c*. capitulum; *e*. pars externa; *m*. pars media.

Fig. 4*h*. Capitulum of the same petasma, from behind; × 72.

Fig. 5. *Acetes spiniger* n. sp.

Fig. 5*a*. Anterior part of carapace with right eye, antennula and squama of a male, from above; × scarcely 7.

Fig. 5*b*. Front end of the carapace of a male, from the left side; × 29.

Fig. 5*c*. End of third peduncular joint of left antennula with lower flagellum and the proximal part of upper flagellum of a male, from the outer side; × 30.

Fig. 5*d*. Exopod of left uropod of a male; × 9.

Fig. 5*e*. Posterior part of thorax of a male, from below; × 13. *gc*. genital coxæ.

Fig. 5*f*. Posterior part of thorax of a female from Surabaya (Java), from below; × 10.

Fig. 5*g*. Left petasma, from behind; × 22. *e*. pars externa; *c*. capitulum; *pv*. processus ventralis.

Fig. 5*h*. Distal half of pars media of the same petasma, from behind; × 38. *c*. capitulum; *pv*. processus ventralis.

Fig. 6. *Lucifer typus* H. M.-Edw.

Fig. 6*a*. Posterior part of abdomen with left uropod of a male from lat. 5° 31′ N., long. 23° 15′ W., from the left side; × scarcely 17.

Fig. 6*b*. Terminal part of the exopod of the uropod shown in fig. 6*a*; × 50.

Fig. 6*c*. Terminal part of the exopod of left uropod of another male; × 50.

Fig. 6*d*. Terminal part of the exopod of left uropod of a female from the same locality in the Atlantic; × 50.

Fig. 6*e*. Telson of a male from the same locality, from the left side; × 43.

Fig. 6*f*. Telson of another male from the same locality, from the left side; × 43.

Fig. 6*g*. Major part of the peduncle of first left pleopod of a male from lat. 5° 31′ N., long. 23° 15′ W., from the inner side; × 78. The petasma is partly unfolded and its rather narrow terminal portion removed from the pleopod. *p*. process at the margin of the pleopod beyond the petasma.

Fig. 6*h*. Terminal portion of the same petasma drawn with transmitted light so that the strongly chitinized parts are rendered with dark shading; × 160. *h*. long-stalked hook; *pv*. processus ventralis; *s*. dark undulating transverse lines.

Fig. 6*i*. Terminal portion of another petasma drawn with transmitted light, and processus ventralis has been taken out; × 160. The lettering as in fig. 6*h*.

Fig. 6*k*. Terminal portion of a third petasma, seen from behind; × 160. The processus ventralis, *pv*., has been turned out of the sheath, *sh*.; *h*. hook.

Fig. 7. *Lucifer orientalis* n. sp.

Fig. 7*a*. Posterior part of abdomen with left uropod of a male from Stat. 203, from the left side; × 14.

Fig. 7*b*. Terminal part of the exopod of the uropod shown in fig. 7*a*; × 50.

Fig. 7*c*. Terminal part of the exopod of left uropod of a female; × 50.

Fig. 7*d*. Telson of a male, from the left side; × 43.

Fig. 7*e*. Peduncle of first left pleopod of a male from Stat. 203, from the inner side; × 54. The petasma is partly unfolded and its narrower terminal portion removed from the pleopod. *p*. process at the margin of the pleopod.

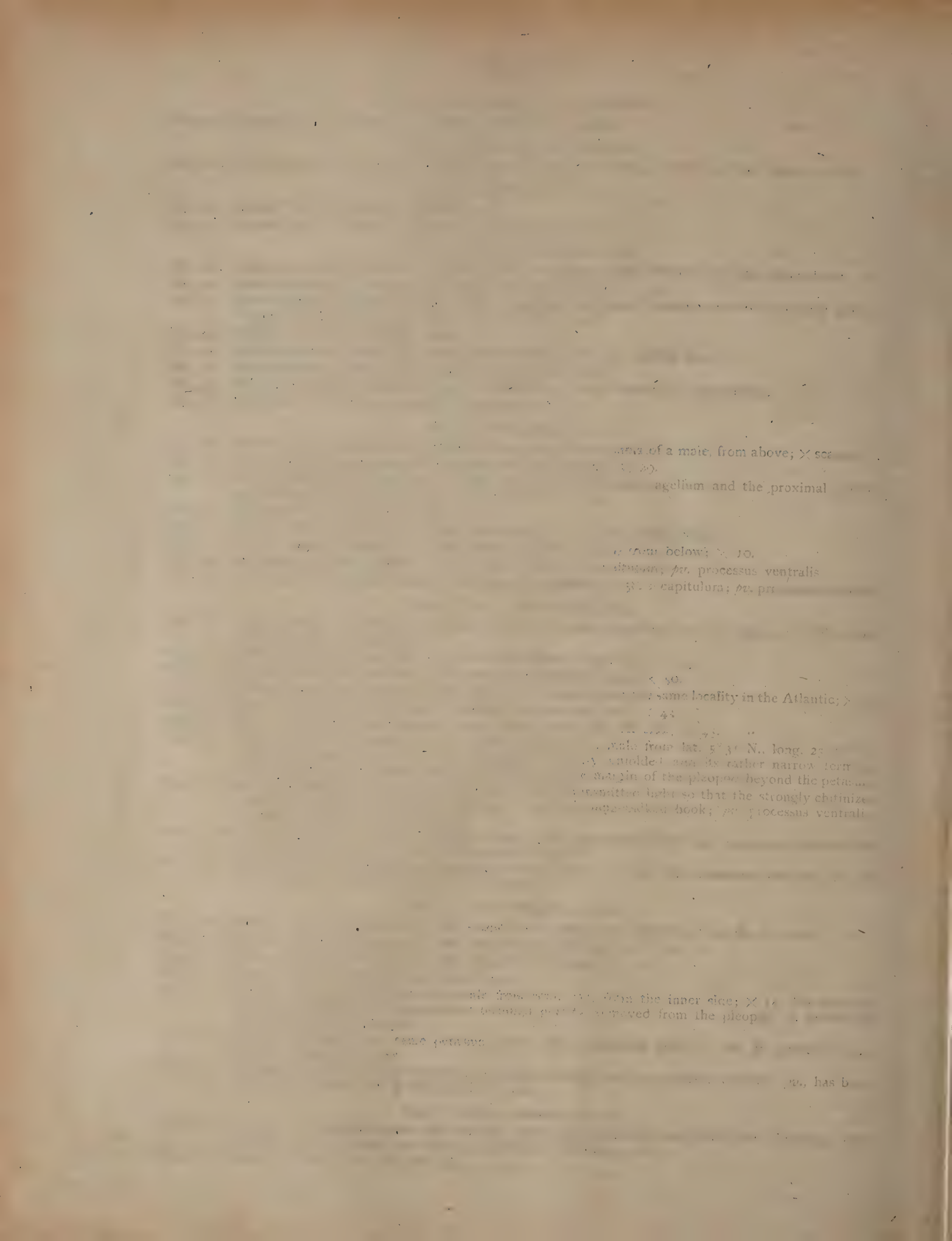
Fig. 7*f*. Terminal portion of the same petasma drawn with transmitted light; × 160. *pv*. processus ventralis; *s*. transverse lines.

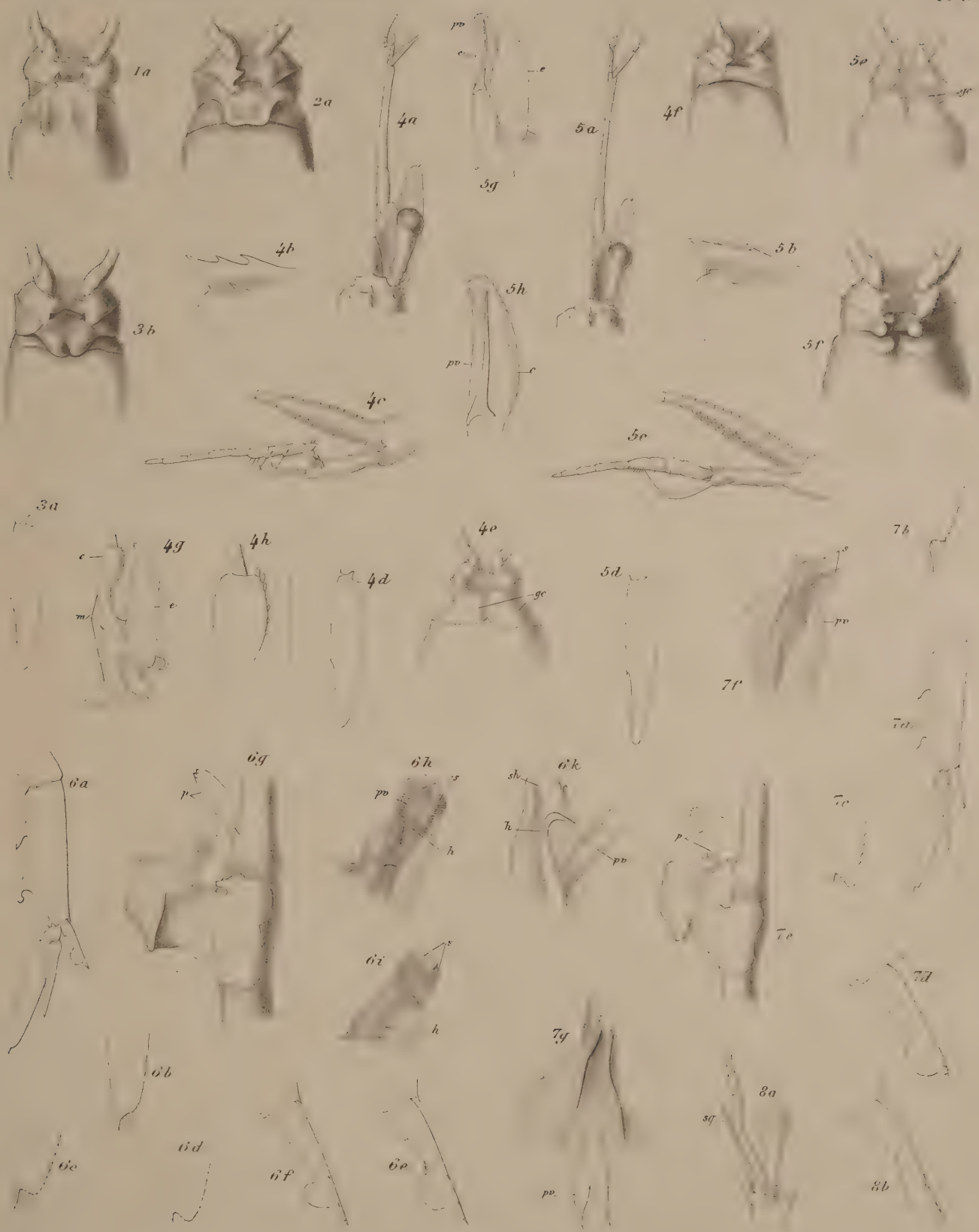
Fig. 7*g*. Terminal portion of another petasma, seen from behind, and the processus ventralis, *pv*., has been turned completely out of the sheath; × 160.

Fig. 8. *Lucifer intermedius* n. sp.

Fig. 8*a*. Front end of cephalothorax with left eye, antennular peduncle, and basal part of antenna with squama, *sq*., of a male from Stat. 37, from the left side; × 21.

Fig. 8*b*. Telson of a male, from the left side; × 40.





1. Acetes dispar n. sp. 2. A. dispar var. vel sp. n. 3. A. chinensis n. sp. 4. A. serrulatus Kr. 5. A. spiniger n. sp.

6. Lucifer typus H. M.-Edw. 7. L. orientalis n. sp. 8. L. intermedius n. sp.

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PLATE V.

Fig. 1. *Lucifer intermedius* n. sp. (Continued).

Fig. 1*a*. Posterior part of abdomen with left uropod of a male from Stat. 37, from the left side; × 29/1.
Fig. 1*b*. Terminal part of the exopod of the uropod of the same male; × 60.
Fig. 1*c*. Terminal part of the exopod of left uropod of another male from Stat. 37; × 60.
Fig. 1*d*. Terminal part of the exopod of left uropod of a female from Stat. 37; × 60.
Fig. 1*e*. Major part of the peduncle of first left pleopod of a male from Stat. 37, from the inner side; × 74. The petasma is in its normal position, with its terminal portion across the peduncle. *l*. two protruding plates or lamellæ; *m*. membranous part of the sheath; *p*. process at the margin of the pleopod.
Fig. 1*f*. Distal third of left petasma, drawn with transmitted light, so that the strongly chitinized parts have dark shading, and seen from the inner side; × 170. *l*. two protruding plates; *m*. membranous part of the sheath; *pv*. processus ventralis; *s*. fine dark transverse lines.
Fig. 1*g*. Distal third of another petasma seen mainly from the outer side; × 170. *l*. two protruding plates; *pv*. processus ventralis, turned out of the sheath.

Fig. 2. *Lucifer penicillifer* n. sp.

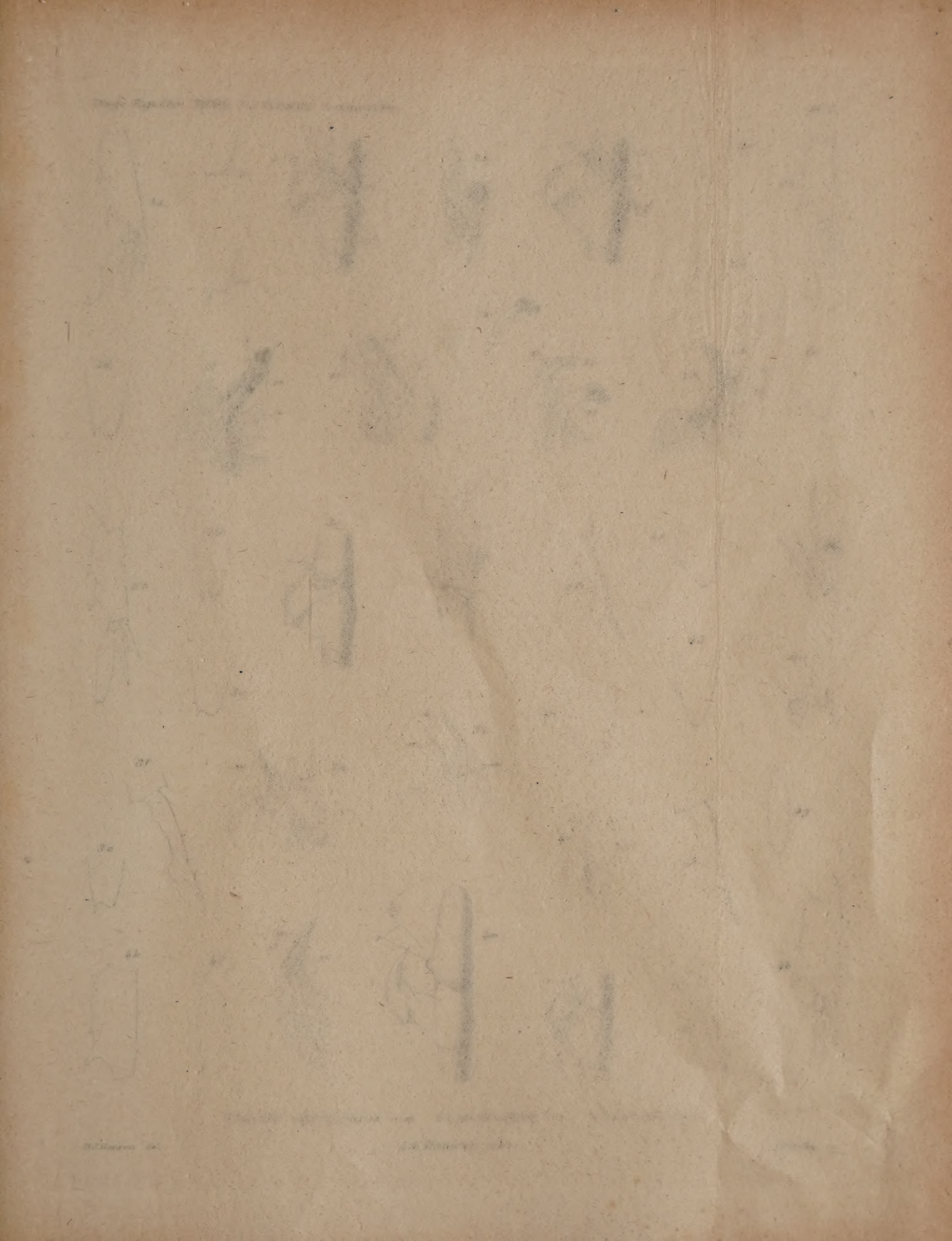
Fig. 2*a*. Front end of cephalothorax with left eye, antennular peduncle, and basal part of antenna with squama, of a male, from the left side; × 22.
Fig. 2*b*. Posterior part of abdomen with left uropod of a male from Stat. 109, from the left side; × 18.
Fig. 2*c*. Terminal part of the exopod of the uropod of the same male; × 54.
Fig. 2*d*. Terminal part of the exopod of left uropod of another male; × 54.
Fig. 2*e*. Terminal part of the exopod of left uropod of a female; × 54.
Fig. 2*f*. Telson of a male, from the left side; × 52.
Fig. 2*g*. About half of the peduncle of first left pleopod of a male from Stat. 109, from the inner side; × 78. The petasma is in its natural position, with its terminal portion across the pleopod. *ch*. strongly chitinized distal part of the sheath; *m*. membranous part of the sheath; *p*. process on the peduncle.
Fig. 2*h*. Distal third of left petasma drawn with transmitted light and seen from the inner side; × 180. *ch*. strongly chitinized scabrous part of the sheath; *m*. membranous part of the sheath; *pv*. processus ventralis.
Fig. 2*i*. Terminal portion of another left petasma, from the outer side; × 180. *ch*. strongly chitinized scabrous part of the sheath; *pv*. processus ventralis, turned out of the sheath.
Fig. 2*k*. Processus ventralis of a fourth petasma showing its end to be bipartite; × 180.

Fig. 3. *Lucifer Faxonii* Borrad.

Fig. 3*a*. Front end of cephalothorax with left eye, antennular peduncle, and basal part of antenna with squama, of a male from Stat. 184, from the left side; × 23.
Fig. 3*b*. Posterior part of abdomen with left uropod of a male from the same locality, from the left side; × 12.
Fig. 3*c*. Terminal part of the exopod of left uropod of a male; × 40.
Fig. 3*d*. Terminal part of the exopod of left uropod of another male; × 40.
Fig. 3*e*. Terminal part of the exopod of left uropod of a female from the same station; × 40.
Fig. 3*f*. Telson of a male, from the left side; × 35.
Fig. 3*g*. Major part of the peduncle of first left pleopod of a male from Stat. 184, from the inner side; × 78. The petasma is in its natural position, with its terminal portion across the pleopod *p*. process on the peduncle.
Fig. 3*h*. Distal third of the petasma removed from the pleopod, of which a small part together with a small portion of the broad part of the petasma is shown, from the inner side; × 140. *p*. process on the peduncle; *pv*. processus ventralis visible through the sheath.
Fig. 3*i*. Terminal portion of the petasma of another male, from the inner side; × 170. *ch*. strongly chitinized distal part of the sheath; *m*. membranous part of the sheath; *pv*. processus ventralis turned out of the sheath.

Fig. 4. *Lucifer Hanseni* Nobili.

Fig. 4*a*. Anterior half of cephalothorax of a male (black-eyed specimen) from Stat. 142, from the left side; × 18.
Fig. 4*b*. Posterior part of abdomen with left uropod of a male from Stat. 142, from the left side; × 18.
Fig. 4*c*. Terminal part of the exopod of left uropod of a male from the same station; × 48.
Fig. 4*d*. Terminal part of the exopod of left uropod of another male from the same station; × 48.
Fig. 4*e*. Terminal part of the exopod of left uropod of a female from the same station; × 48.
Fig. 4*f*. Exopod of left uropod of a quite small, perhaps scarcely adult male, 7 mm. long, from the same locality, viz. Stat. 142; × 30.
Fig. 4*g*. Exopod of left uropod of a young female, 5.7 mm. long, from the same locality; × 33.
Fig. 4*h*. Telson of an adult male from the same station, from the left side; × 43.
Fig. 4*i*. Telson of another adult male from the same station, from the left side; × 43.
Fig. 4*k*. Sixth abdominal segment of a male (with the eyes yellowish brown) from Stat. 106, from the left side; × 16.
Fig. 4*l*. Part of the peduncle of first left pleopod of a male from Stat. 106, from the inner side; × 77. The petasma is almost in its natural position, as its distal part is on the figure turned only slightly to the left. *p*. process on the peduncle.
Fig. 4*m*. Peduncle (the basal part omitted) of first left pleopod of a male from Stat. 142, from the inner side; × 80. The petasma is unfolded, so that its distal half is parallel with the peduncle. *p*. process on the peduncle.
Fig. 4*n*. Distal half of the petasma exhibited in fig. 4*m* and drawn with transmitted light, from the inner side; × 160. *ch*. strongly chitinized part of the sheath; *pv*. processus ventralis.
Fig. 4*o*. Terminal portion of the petasma of another male from the same station, from the inner side; × 160. *pv*. processus ventralis, turned out of the sheath, *sh*.



1. Lucifer intermedius n. sp. 2. L. penicillifer n. sp. 3. L. Faxonii Borrad. 4. L. Hanseni Nobili.

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